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Construction and Operation of Swaging Dies

By Frank W. Curtis
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An outline of the conditions that characterize the swaging of steel, together with detailed examples of dies for performing miscellaneous swaging operations

SWAGING dies, if properly designed, are capable of effecting worth-while savings in the manufacture of sheet-steel products. These savings include the elimination of more costly operations that would be required to form a given shape, as well as a reduction in the amount of material necessary. One of the most essential requirements is to make the upper and the lower dies heavy in construction, so that they will withstand the strain set up during swaging. Pressures ranging from 200 to 500 tons are required for the average run of work, and it is evident that a thin die would break down under the strain after comparatively short use. There is no definite rule for the comparative thicknesses of dies in relation to pressures, but it is always safe to make a die slightly heavier than is required, rather than to have it too weak.

The steel from which the dies are made is the next important factor. Good results have been obtained from a heavy-pressure steel, such as is manufactured by several steel companies. In any event, the steel must be of such a nature that it can be hardened throughout its entire section. If the center portion of the die is left soft, there is a tendency for it to cave in or collapse.

The construction of dies having screw holes close to the swaging surface should be avoided. It is good practice to fasten the die to the shoe by screws entering from the under surface and not to extend the holes into the die further than is necessary. The reason for this precaution is that the die is likely to crack between the screw holes and the point of swaging. A better method is to fasten the dies by clamping rings, thus avoiding the use of holes. In either case, however, the die should be embedded in the die-shoe, so that it will have a good flat bearing surface because any uneveness is likely to cause the die to crack.

The surface of the die upon which the swaging is done should be smooth and free from scratches or other marks. A lapped or highly-polished surface is preferable, since the slightest mark on the swaging surface is apt to hinder the flow of the metal, resulting in an imperfect product. The surface of the die should be relieved to a depth of $\frac{1}{64}$ or $\frac{1}{32}$-in. around the contour of the work, preferably allowing $\frac{1}{8}$-in. clearance. This practice will not only give a longer life to the die, but will both simplify the polishing and the maintenance of the swaging surface. When circular work is being swaged, in which a hub is formed in the upper or the lower die-block, the corners should be kept extremely sharp because the metal has a tendency to crowd into the hole, and is likely to crack the die.

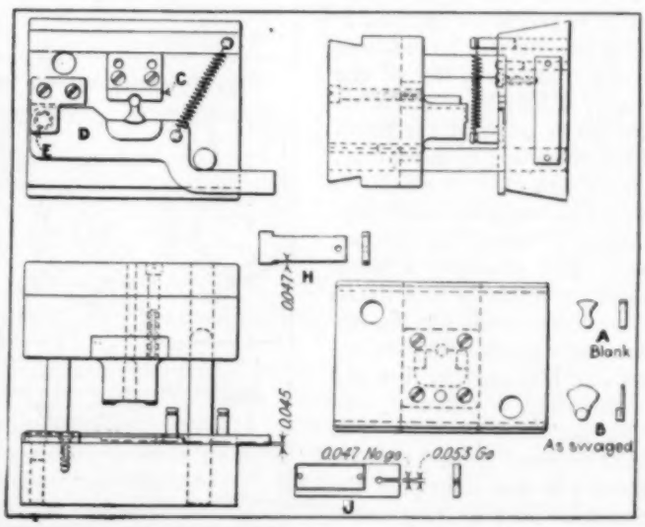


Fig. 1—Die for swaging a segment

Next in line is consideration of the material to be swaged. A soft grade of steel should be used, for, to a certain extent, the success of swaging depends on this factor. Work should be annealed after blanking and before being swaged to remove the hard edge that is usually present. If such an edge is present and swaging

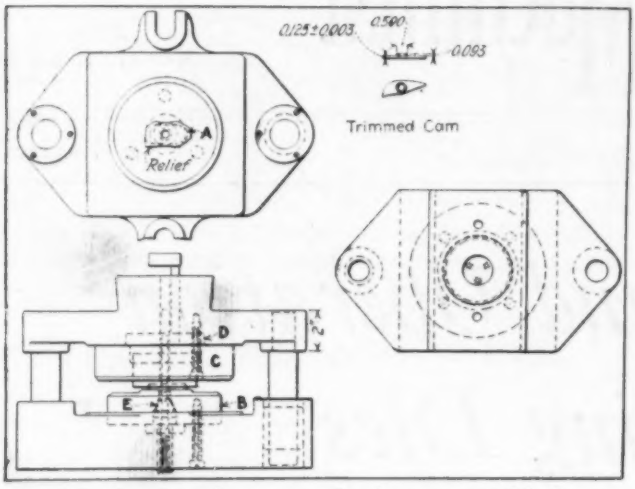


Fig. 2—Swaging a cam having a central hub

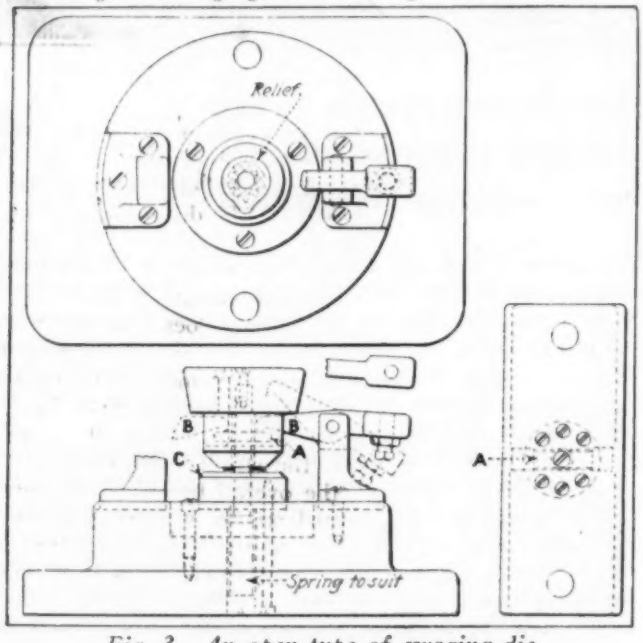


Fig. 3—An open type of swaging die

is attempted, the work usually develops cracks on the outer edge. If there is doubt as to the work being sufficiently soft, it is better to anneal it. Hard, punching-steel cannot be swaged successfully, and if an attempt is made to do so, it is quite possible the die will be cracked. For this reason, it is well to make a hardness test of the work prior to swaging. Usually, a half-hard grade of steel will develop cracks on the outer edge of the blank that will act as a warning. If the reduction is not severe, however, this condition may not exist.

As a rule, the margin of safety in swaging sheet-steel punchings, is to limit the amount of reduction to one-half the thickness of the blank. For example, a blank $\frac{3}{16}$ in. in thickness can be swaged successfully to a thickness of $\frac{3}{32}$ in. Swaging beyond this point can be accomplished, but it is a matter for experimentation before deciding. On screw-machine blanks, this line can be increased to two-thirds of the blank's thickness, and in some cases even more. On this class of work it is not uncommon to reduce flange thickness from $\frac{1}{2}$ to $\frac{1}{8}$ in. The difference in these allowances is due largely to the direction of the grain of the metal. In punching stock, the grain of the work lies parallel with the dies, and in the screw-machine products, the grain is just the opposite.

Swaged metal, in a majority of cases, cannot be bent successfully along the point of swaging. This condition is due to the hardening of the grain, set up by swaging. It is often possible to anneal the work after swaging, and to bend it as much as 30 deg., but where a right-angle bend is attempted, the corner of the stock usually breaks or develops a series of cracks. An exception to this rule is made in the case of a bend that is not severe, or which is not required to be sharp at the inside corner of the bend.

The direction in which a flat piece is to be swaged can be controlled by a set-edge, or nesting plate, placed opposite the desired direction of the flow. This precaution is not necessary for round work, or for parts in which a mere flattening operation is performed, but it is essential when one side of the work is to remain at its normal thickness, and the opposite side, or its specially shaped projection, requires swaging.

Some dies embodying most of the features outlined, are shown in the group of examples herewith. A swaging die for a segment is illustrated in Fig. 1. The work-piece, $\frac{3}{16}$-in. in thickness, is blanked to the outline shown at *A* in a previous operation, and in the die shown it is formed to the shape indicated at *B*, the reduced portion being swaged to 0.047 in. in thickness. The blank is located in the die by the set-edge *C* and the swinging nest-plate *D*. The nest-plate is pivoted at *E* so that it can swing outward as the punch swages the blank. The

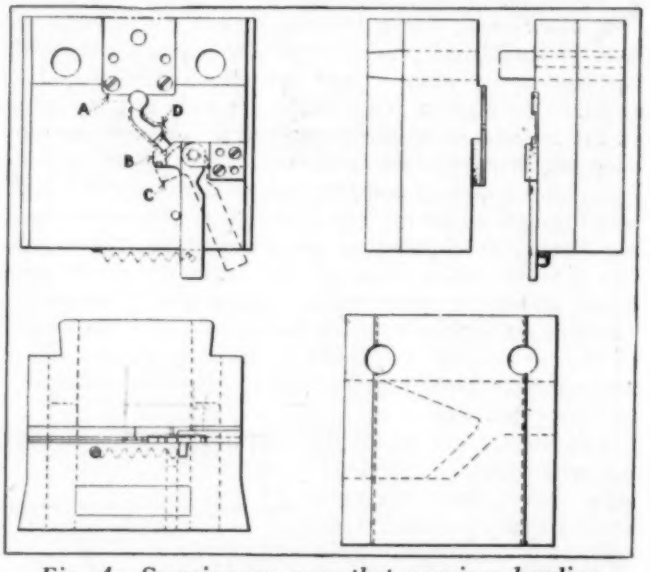


Fig. 4—Swaging an arm that requires bending

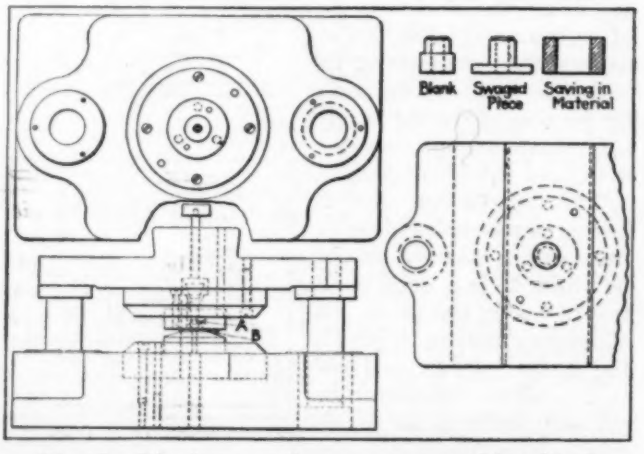
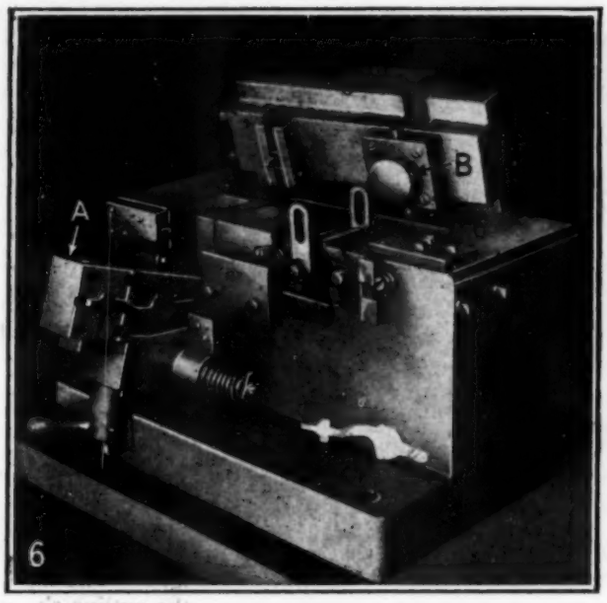


Fig. 5—Die for swaging a screw-machine blank



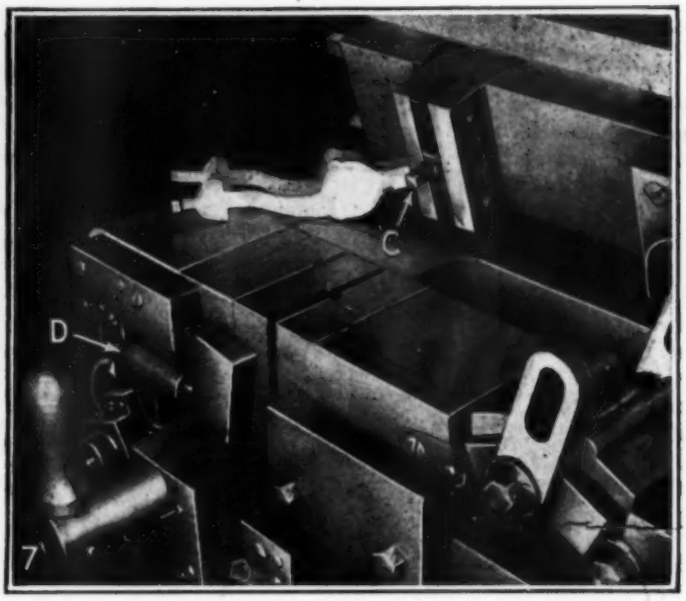


Fig. 6—An unusual type of swaging die. *Fig. 7—Close-up view of a compound-action die*

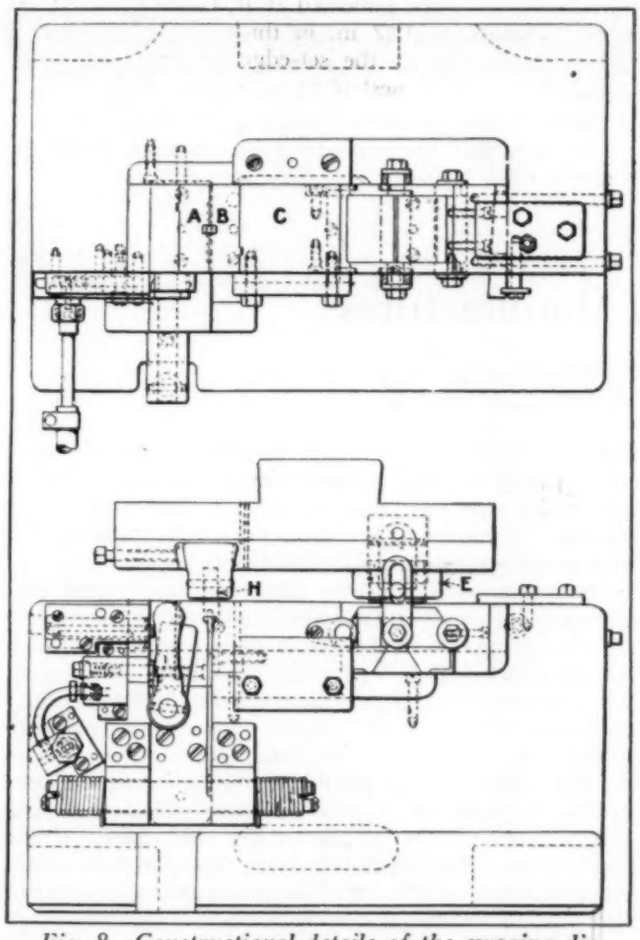


Fig. 8—Constructional details of the swaging die

die-block, solid in construction, and the punch, made of a separate piece attached to the cast-iron punch holder, are reconditioned by grinding and repolishing the swaging faces. The stepped gage *H* is used in connection with the grinding of the punch. The swaged portion of the segment is checked by the gage *J*. Two guide pins are attached to the die to keep the members in alignment.

The die illustrated in Fig. 2 swages the blank outlined at *A* so that a hub, equal to the original thickness of the blank is left around the hole, while the outer surface is reduced to $\frac{1}{8}$ in. in thickness. The die *B* is fitted into a counterbored hole in the die-shoe, and is held by three screws. The punch, mounted in the pad *C*, has vertical lost-motion, so that it rests upon touching the work as the ram descends. Actual swaging does not take place until further movement of the ram brings the plate *D* in contact with the punch pad. The metal forming the hub enters the hole in the die and is supported by the pressure ring *E* that strikes a plate located in the die-shoe, when the bottom of the stroke is reached. The action of the ring holds the overall height of the work to size, and, on the upward stroke, it ejects the work beyond the face of the die, so that it can be removed easily. After this operation, the outer edge of the work is blanked and shaved to form a cam.

A similar operation is performed by the die shown in Fig. 3, although the amount of material swaged is not as thick as in the previous case, and the die has no guide pins. In this example, the hub on the work is formed in the punch, from where it is stripped on the upward stroke by the ejector *A*. The arms *B* attached to the die-shoe, force the ejector downward. The hub is not backed up, inasmuch as another operation is employed to size the thickness. Since the die *C* is small in size, it is mounted in a steel cushion set into the die shoe. By using this construction the replacement cost is much less than if a larger die were used. The part shown is a pinion for a counter and has its teeth recut in another die after the swaging has been completed. The purpose of blanking the teeth before swaging, rather than swaging from the solid, is because the metal at the outer edge has more freedom to flow when the shape is made as outlined.

Another plain type of swaging die is illustrated in Fig. 4, in which a solid die and punch are used. The work-piece retains its original thickness at the hub and at the outer end, but is swaged to one-half this thickness at the center portion. The outer end, nevertheless, is afterward milled to the same thickness as that of the swaged portion, because a right-angle bend is required. A bend of this kind cannot be made at a place that has

been swaged, as previously stated. If it were necessary to reduce the entire end portion by some other means of machining, it is evident that a suitable means of holding the work would be difficult, therefore, the advantage of swaging is clearly apparent. The arm is located by the set-edge *A*, and the swinging nest-plate *B*, that takes the position *C* as the work is swaged to the outline at *D*.

The die illustrated in Fig. 5 swages the screw machine-blank indicated at *A*, to the outline shown at *B*. Constructional features are similar to those embodied in the previous examples, although a more pronounced swaging of material is evident. The outer edge of the swaged portion is afterward blanked to form a pinion.

While the dies shown in the foregoing examples are not complicated, some difficult swaging operations reqnire dies of an unusual type. Such a die is illustrated in Fig. 6. The operation performed is the swaging of the end of the arm shown resting on the die at the lower right-hand corner. The die-shoe is made of a solid-steel block to which the operating units are assembled. Resting on top of the die-shoe is the punch assembly. The work-piece is placed in the swinging die-block *A*, after which the block is swung back into the die-shoe. At the right is located a similar block, with the exception that it has a sliding action, operated by a toggle joint that is brought in motion when the pad *B*, located on the punch holder, descends. A close-up view of the swinging and sliding die-blocks in the closed position is illustrated in Fig. 7. The swaging punch that enters the openings in the die-blocks, is seen at *C*. Standing on the die-shoe are work-pieces before and after being swaged. The ears on each side of the arm, located directly under the end that is swaged, are blanked on the arm for the purpose of giving it support, and to avoid swaging action from taking place somewhere nearer the center of the piece. These ears are trimmed off later, since they are not a necessary part of the arm.

With a die of this type, it is evident that serious consequences would ensue if the press were tripped accidently while the swinging die-block was only partly closed. To offset this possible danger, the air-operated attachment *D*, working in conjunction with the trip mechanism of the press, which is also air-operated, is used.

A layout of the die showing constructional details, is illustrated in Fig. 8. In this view, the punch is shown when the ram is at the bottom of its stroke. The die-blocks *A* and *B* are aligned and held to the back-up plates by tongues and screws, so that they can be removed easily for resharpening or replacement. The pad *E*, operating the toggle action of the sliding block, is backed up by a rubber cushion, so that after the dies have been closed, the pad recedes into the punch holder until the ram reaches the bottom of the stroke. The swaging punch *H* is arranged so that it does not strike the work until after the dies have been closed. This example shows an excellent case in which the shape of the part had to be changed to permit swaging, accomplished by means of ears, and gives a comprehensive idea of some of the problems confronted in swaging operations.

The data and illustrations were obtained from the National Cash Register Co., Dayton, Ohio.

Attracting New Manufactures

By A. W. Forbes
Forbes & Myers

ALL are familiar with the circulars and letters that chambers of commerce get out to attract industries to their towns. I have just received a similar circular from a large terminal company, which may not be typical, but which brings out the weakness of these circulars.

Buildings, insurance, gas and electricity, shipping facilities, are all described. It makes an attractive picture, but after all they are only minor items. No possible improvement in these features could induce us to move. The big item of costs is employees' wages. Not common labor, which can be secured anywhere, but the skilled employees.

I do not recall a single circular advertising a town that described the facilities for living in the same way that they describe the shipping facilities. It is natural that factories already located in a town might not want to advertise that their employees were available for a newcomer. But there is one class of employee that they might be willing to advertise, the coming generation. Probably 3 per cent of all employees are in their first year of work. Considering the number of girls who only work a few years before marriage it is higher than that. Many established plants do not have opportunities for beginners, so they should be available for the newcomer. We might expect that these circulars would tell what the town is doing to prepare the younger generation for profitable employment, but they never do.

Is it safe to assume that a town that fails to suggest that it is helping the younger generation toward skilled employment is doing nothing along this line? Or do they think that the employer is not interested in employees? Some towns are doing practically nothing. But who would want to locate in such a town?

Other towns like the one where we are located have extensive programs for vocational education. Here there are two large trade schools, a large commercial high school, a technical college which supplies a larger number of engineers than there is room for in the city, continuation schools, night schools, and many employers offering to train boys for their respective industries. At first sight it would seem that the field was well covered. It must be a great help to those industries that need the kinds of employees that the schools prepare, and in general that means the large plants with mass production methods. But we do not happen to be one of them. The vocational schools are the worst competitors of the small shop.

Is there no town that is trying to co-operate with all the industries so that every boy will find congenial employment at the highest level of accomplishment, and so that every skilled job or responsible position will find some member of the coming generation to fill it? Of course this ideal cannot be secured. But some town might try to come as near to it as possible. I do not know any stronger inducement to locate in a town than such a plan of co-operation.

Fig. 1—General view of the machine shop

Keeping Locomotives in Service on Cuban Railways

By Fred H. Colvin
Editor, American Machinist

THE principal railways of Cuba are divided into two groups, namely, the United Railways of Havana, which controls the lines from the Province of Pinar del Rio, on the west, to the Province of Santa Clara on the east; and the Consolidated Railroads of Cuba, which serve the island from Santa Clara to Santiego, in the eastern end. The United Railways of Havana, with which this article deals, is an English-owned company, while the Consolidated Railways of Cuba is an American company having its headquarters at New York.

The Locomotive shops of the United Railways of Havana are at Cienaga, a suburb of the city of Havana. These shops are charged with the maintenance of about 400 locomotives of 36 different types, some of them being of English make, as the road was originally financed by English capital. The great variation in the types of locomotives, averaging approximately eleven of each kind, is a considerable handicap in securing the greatest economy in maintenance. Such a handicap, however, is by no means confined to this railroad, since there are comparatively few roads on which this subject seems to have received sufficient attention.

One of the noticeable results of the large variety of locomotives is in the great number of tires found in the tire storage department. Another is the great variety of driving box and rod brasses that it is necessary to replace. The reserve stock necessary is, of course, still further increased by the distance from the sources of supply and the time required for delivery.

The necessity of keeping the rolling stock in good shape during the sugar grinding season can be realized from the fact that approximately 75 per cent of the year's tonnage is handled in 120 days.

The Cienaga shop is of steel construction having corrugated siding, and is well suited for the climate of Cuba. While its machine equipment is not entirely modern, it contains a goodly number of modern machines, among which English machine-tool builders are quite well represented The general arrangement of the shop and the way in which the machines are located can be seen from Figs. 1 and 2. It will be noted that the machines nearest the columns are belt driven, while the lathes in the line near the center of Fig. 1, all have individual motors. The method of suspending the countershaft of a grinder above the lineshaft is shown at the left in Fig. 2. This bay is served by 5½-ton traveling cranes, supplemented at the right by the individual cranes on the draw-cut shapers. The floor is of impregnated wood block, which seems to be quite a favorite in this

Fig. 2—The other end of the shop. Note the method of hanging the countershaft for the grinder at the left. The shop is served by traveling cranes, supplemented by individual jib cranes at some of the machines. Note English link grinder at extreme left

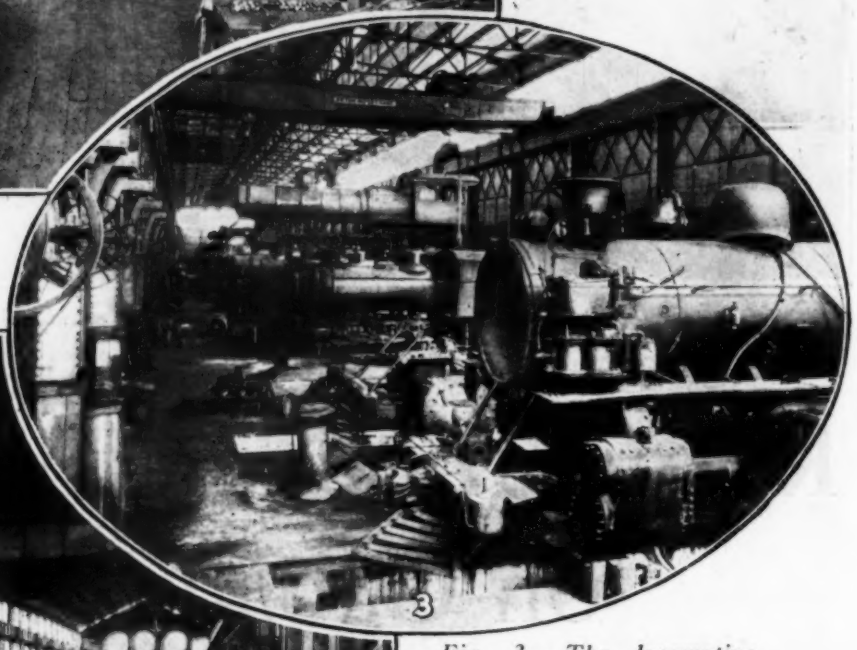


Fig. 3—The locomotive erecting shop is served by a 60-ton traveling crane

Fig. 4—In end of the shop boilers are repaired and new ones built

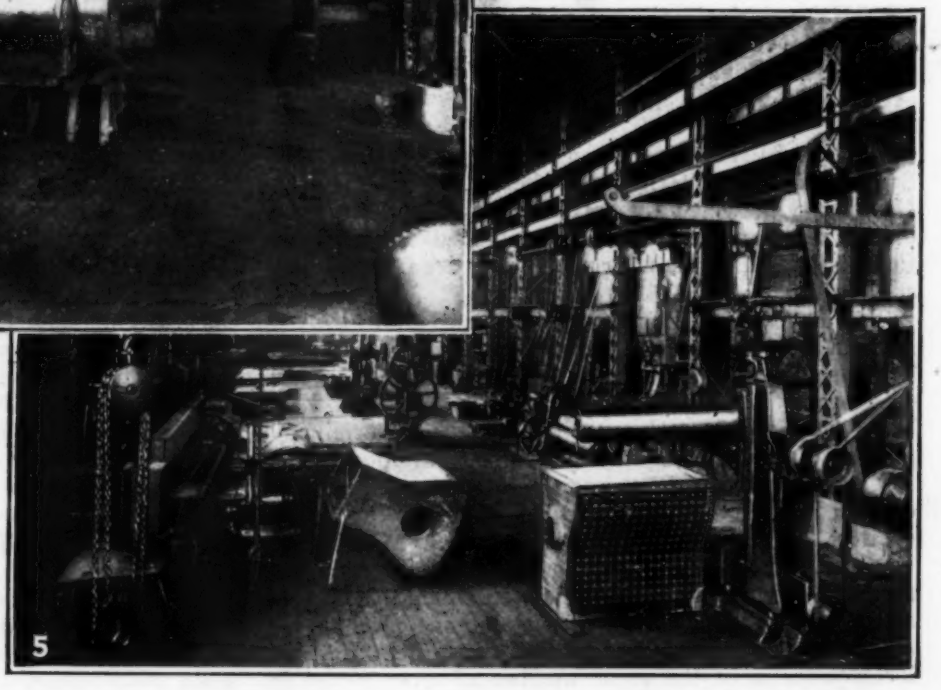


Fig. 5—The other end of the boiler shop. The equipment includes a full line of machinery for making boilers. The shop has a traveling crane

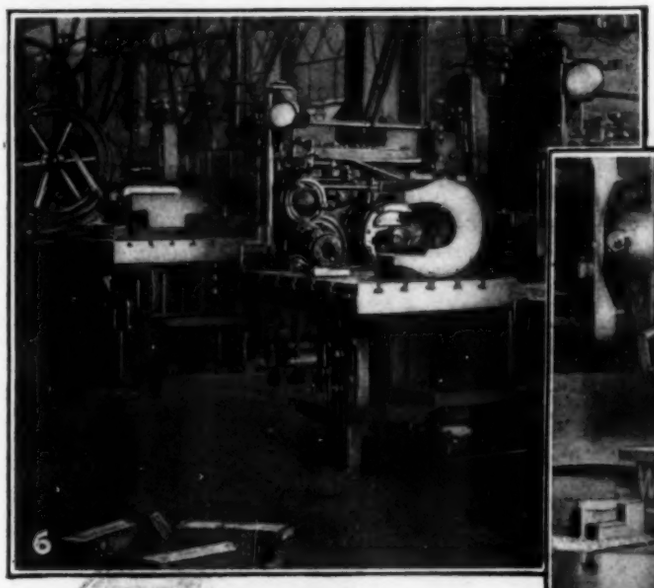


Fig. 6—Machining driving boxes and other parts. The work is being done on a draw-cut shaper

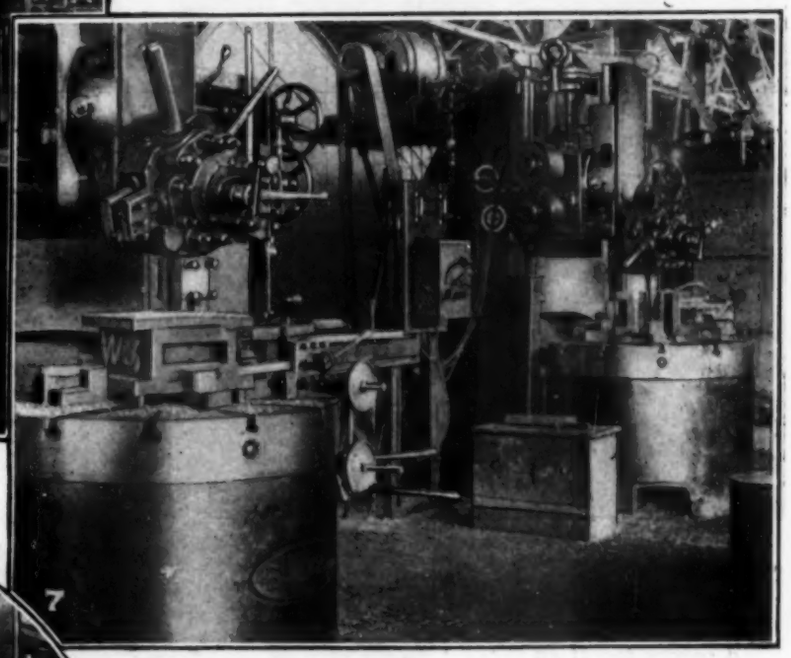


Fig. 7—Boring rod brasses. The work is done on a battery of vertical boring mills

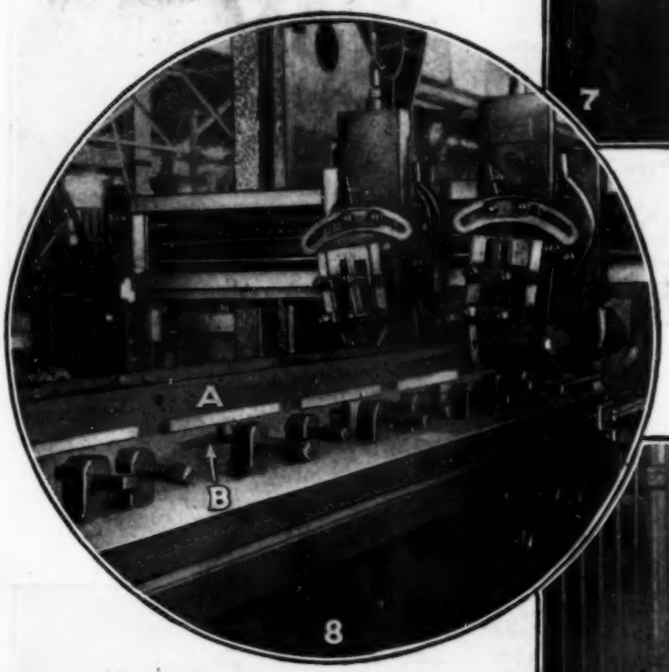


Fig. 8—Planing shoes and wedges—strung in long rows on the planer table

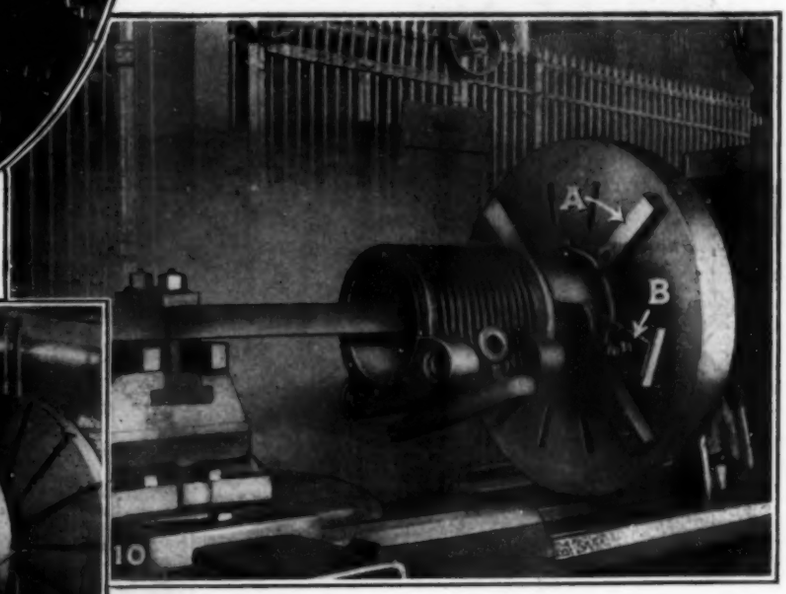


Fig. 9—Turning the journals of driving axles. Belt driven on dead centers

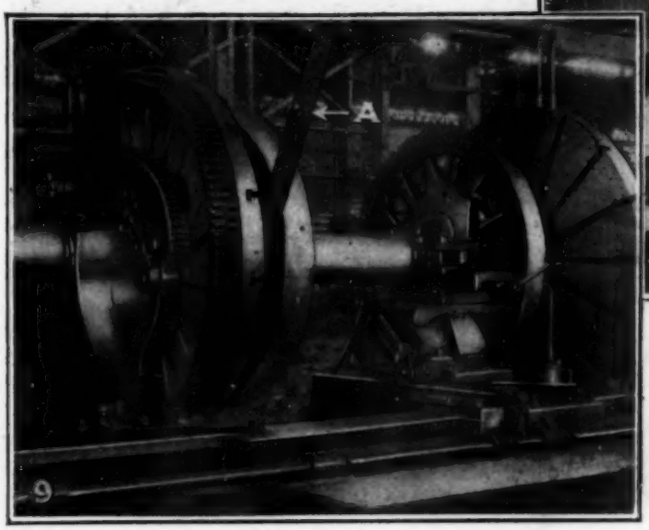


Fig. 10—Reboring an air-pump cylinder. The cylinder is centered in the chuck

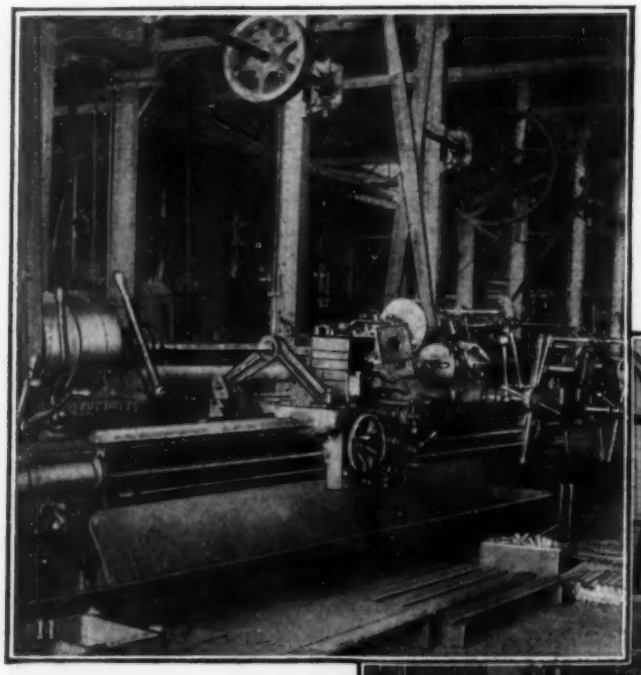


Fig. 11—Turning and threading long stay-bolts. The lathe has a square turret on the carriage and a tilted turret in place of the tailstock

Fig. 12—The rod department. Some of the benches are of wood, while others are of metal. Supports for the metal benches are made from old boiler tubes. The crown brass to be seen on the bench belongs to an English locomotive

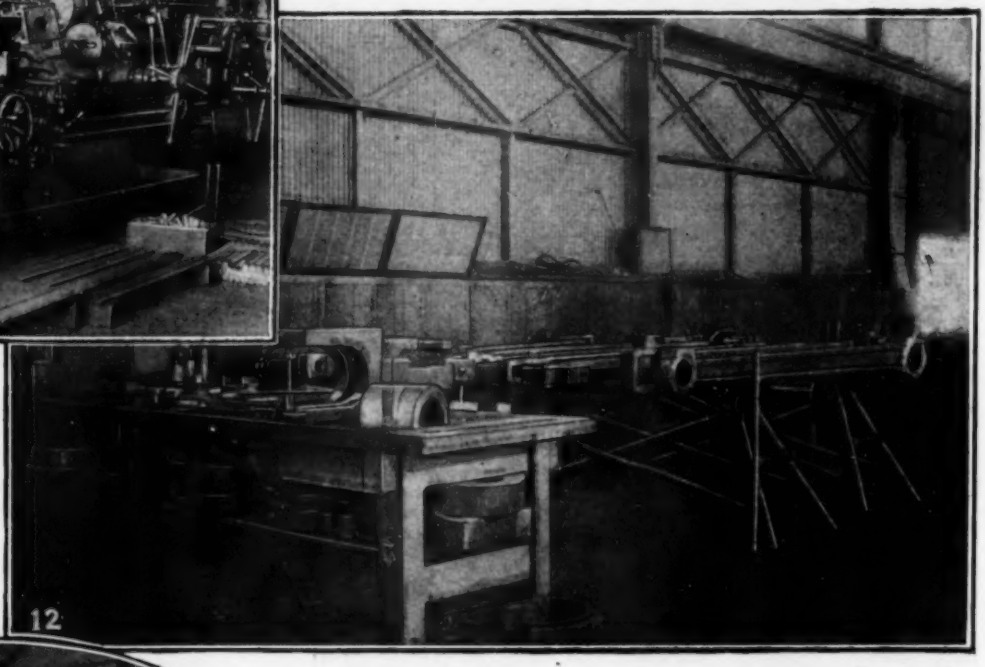
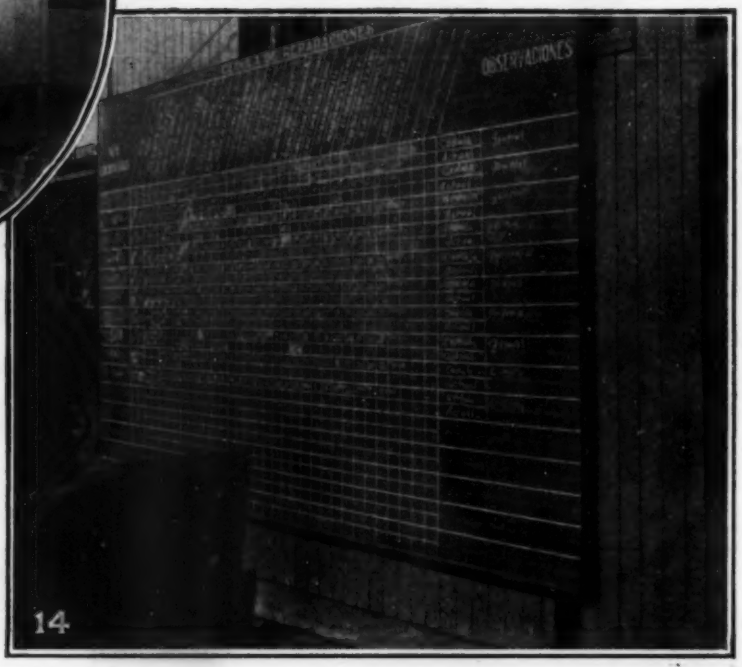


Fig. 13—Inclosure for arc welding. The low fence was built to protect the shopmen from the glare of the arc. The fence is open at the back, also at the bottom, to secure ventilation for the welder

Fig. 14—Schedule board of repairs. The repairs to be made on different locomotives, together with the progress being made, are listed under appropriate headings



locality. Other bays of the shop are shown in Figs. 3, 4 and 5, illustrating the erecting side of the shop with the pits, and the 60-ton crane at work; a portion of the boiler shop; and the method of handling fireboxes. In the bay shown in Fig. 5, jib cranes supplement the traveling cranes. Some of the English machines are shown in Figs. 2 and 5, the one at the left in Fig. 2 being a Beyer-Peacock link grinder, while in Fig. 5 a Manchester-built radial drill can be seen.

Taking up some of the operations in detail, Fig. 6 shows two of the battery of Morton draw-cut shapers, one being at work on driving boxes and the other on a special strap. These machines are used on a large variety of work. Large rod brasses are being bored on the two Bullard machines in Fig. 7. A Colburn machine completes this battery. Driving-box shoes and wedges are machined on the planer shown in Fig. 8. A central support in the shape of a box girder *A* is used as an abutment for a string of shoes on each side, which are held in the usual manner by screw stops and double-pointed hold-downs, as at *B*. Shoes and wedges are planed in sufficient quantities to allow long set-ups and to secure efficient machining time.

Among the equipment is a new, Niles-Bement-Pond driving-wheel lathe, on which work is handled in the usual manner. A considerably older machine is utilized for turning axle journals, using it as a dead-center machine and driving the axle to be turned by means of a belt *A* running on a pulley fastened to one of the driving wheels, as in Fig. 9. This method has been found to give very satisfactory results and is now common practice for journal turning in the Cienaga shop.

Air-pump cylinders are rebored in the motor-driven, geared-head lathe shown in Fig. 10. The cylinder is centered by means of the screw-operated jaws *A* and is held firmly in position by clamps, as at *B*. The boring tool is held in the end of a heavy tool shank so as to reduce vibration as much as possible. Staybolts are turned and threaded in the 24-in. LeBlond heavy-duty lathe shown in Fig. 11, utilizing the hinged follower-rest shown on the left side of the lathe carriage. This lathe is equipped with a turret in place of the regular tailstock, and has been found very satisfactory.

Rod Department

A portion of the rod department is shown in Fig. 12, both wood and metal being used for benches and supports for the connecting rods. The metal supports shown at the right are made up of old boiler tubes of various sizes, as can be seen. The crown brass shown on the corner of the wooden bench is from one of the English locomotives.

Brass shoes are being used on crossheads in place of shoes of cast iron or cast steel, babbitted. The electric arc is being used largely for welding, and also for building up worn surfaces on parts of various kinds. Some of the work to be handled in this way is shown in Fig. 13, which also shows the method of protecting the other men in the shop from the glare of the arc. The welding operator has a small enclosure, open at the back, and high enough to protect the eyes of all those outside from the blinding glare. It is open at the bottom to allow ventilation, which is always a problem in a tropical country, and the fact that the enclosure does not completely hide the operator, tends to make him realize that he is under supervision, the same as other men in the shop. Oxyacetylene is used in all cutting work and in welding cast iron.

Flue welding is done with anthracite coal, and since this coal costs about $35 per ton in Cuba, its conservation is an important item. New flue welding equipment is being contemplated. On account of the cost of coal, fuel oil is used exclusively for firing the locomotives. One of the byproducts is a residue that when mixed with soot or fine sand, makes a very compact and satisfactory walk. It can also be used for filling purposes. Native cedar is largely used for pattern work. Other native woods, such as mahogany, are also used for various purposes. The Cienaga shop has a very complete boiler-washing plant, equipped with both hot and cold water. A steam-pipe line extends to various points of the yard so as to be readily available in starting the oil burners in firing up cold locomotives.

A bulletin board showing the repairs scheduled for different locomotives and the progress that is being made, is shown in Fig. 14. The names are, of course, in Spanish. The locomotive number is at the left and the remarks at the right. "Cedula de Reparaciones" is not so different from our own words for schedule of repairs.

Stabilizing Drafting Details to Facilitate Production in the Shop

By John F. Hardecker

JACK BROWN chanced to meet his old friend, Ed Jones, who is chief draftsman at the Eagle Aircraft Company, one Sunday morning on the links. Their talk gradually drifted around to "shop" and Jack expressed his annoyance at the many questions that were continually arising from the shop on details of construction. "It just seems," Jack continued, "as though no matter how we detail certain things, the shop invariably asks for permission to do it just a little differently. Not but what it proves all right to do it the shop's way, but it always means lost time to investigate and change the drawing. So, while I generally agree with the shop if it is at all feasible, because I realize that it is the little things such as these that often generate real friction between the drafting room and the shop, I don't like this continual changing at all."

"Well," replied Ed, "I don't believe there's any game more susceptible to that abuse than aircraft, but we have solved the difficulty very nicely. For such parts as tanks, radiators, cowlings and so forth, we have carefully prepared sheets of standardized details in collaboration with the shop involved, representing the consensus of opinion as to the best shop practice. These sheets are issued as regular drawings and are supplied to the shop, and all drawings for these parts on particular airplanes refer to these standardized drawings for details. Where the detail is so to be special, we actually show it in the individual drawing for that part, otherwise it is to be constructed in accordance with the standardized drawing. Then, if the shop wishes to change it, it knows that the first question it will have to face will be whether it recommends that the standardized drawing should be changed, and why, or whether it can show reasons why this part should be made in a special manner from that called for by the standardized drawing. This not only makes the shop think before wanting it different, and saves time and friction in the drafting end, but it permits the shop to tool up to better advantage on these stabilized details, knowing that we, too, on the drafting end will be consistent in our specifications."

Book Reviews

BUSINESS CYCLES AND BUSINESS MEASUREMENTS. By Carl Synder. Three hundred and twenty-six pages, 5¾x8¾ in., cloth boards. Indexed. Fifty-five charts. Published by the Macmillan Co., New York City. Price $6.

THE author of this book has attempted by numerous studies to show how the executive can use business statistics to judge business trends in a kind of actuarial manner. The extensive use of business charts dates back only a few years, but in this time a great deal of investigation work has been done on the subject.

Since standards change, and figures are only relative, what might be considered as a large increase over a figure for ten years ago might represent a serious decrease in the rate of growth from preceding periods. Simple calculating and charting of figures for definite periods, therefore, does not necessarily indicate business trends. With this in mind, the author has attempted to find relations between statistics with the object of choosing those combinations that give a barometer of conditions surrounding general business.

The book has twelve chapters, and also an appendix of 74 pages of statistical tables covering a period of about 50 years. The first two chapters discuss the nature of business cycles, and the significance of economic growth. The next two take up the measurement of business cycles, and the choice of a base for index numbers. The fifth chapter is devoted to the explanation of a new measure of the volume of trade, which is aimed to be one indication of the trend of general business of the country. This chapter is illustrated by numerous charts to show the different aspects of the problem.

Other chapters take up the subjects of bank deposits, interest rates, prices, business failures, and other measures of the business cycles. It shows how these varying factors are weighted for use in combination. The collection of statistical data given in the appendix should be valuable for those firms or individuals who desire to make use of the methods and devise business charts to suit their own needs.

HOW TO INFLUENCE MEN. By Edgar J. Swift, Head of Department of Psychology, Washington University. Three hundred ninety-two pages, 5½x8 in., cloth boards. Published by Charles Scribner's Sons, New York. Price $3.

THE author's book, "Business Power Through Psychology," brought out in 1925, was so successful, in spite of its title, that it has been revised and enlarged to its present form and name. As revised the book is unquestionably worth study by any man whose work has to do with selling, sales direction, executive leadership and handling of men, individually and collectively. This sounds like a broad statement but, after all, psychology underlies human relations in business dealings or elsewhere, and psychology is the author's specialty. Perhaps the most important contribution of this book is the "debunking" of the pseudo-psychological patter that has been used in making worthless books on salesmanship.

A little over half the book is devoted to selling, the five chapters included taking up respectively the psychology of salesmanship, creative salesmanship, the strategy of salesmanship, the tactics of salesmanship and the selection of salesmen. The chapter on selecting salesmen leads logically to a chapter on the psychology of personnel management which is followed by a particularly excellent chapter on thinking as an asset in business. This chapter and the final one on mental efficiency will be distinctly disturbing to the average executive and business man because the author dares to assail the value of experience. The disturbing effect will be decidedly beneficial if the reader will open his mind long enough to get what is in these two chapters.

The psychology of managing men and of leadership are treated in the remaining chapters and there is an appendix that reviews the psychological facts underlying salesmanship.

Neither of the two titles used for this book is a very happy one as each smacks of the type of "psychology" that is so rightly condemned in the book. Don't let them mislead you, for the text is thoroughly sound and easy reading. The only adverse criticism that might be made is that the author sometimes falls a prey to the ailment against which he warns the salesman—talking his prospect to death. His lapses, however, are not frequent.

PROFITS, PROGRESS AND PROSPERITY. By Arthur B. Adams, Dean of the School of Business and Professor of Economics, University of Oklahoma. One hundred seventy-three pages, 5¾x8 in. Cloth boards. Indexed. Charts and tables. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York. Price $2.

THIS book is intended to be an analysis of the present-day industrial system as regards its operation under different conditions of the general price level. A part of the book is in effect aimed as a refutation of the deduction of Foster and Catchings in their book Profits. The subject of the volume is one that is receiving an increasing amount of attention from economists but also one to which it is difficult to fit general laws.

The book is divided into ten chapters, with sub-grouping of important subjects. In the first chapter the author takes up the contentions of Messrs. Foster and Catchings, and then gives a general view of his own conclusions in regard to money distribution and business cycles. In the succeeding chapters he discusses various phases of the situation. According to the author, major business depressions are not caused by the failure of industry to distribute enough money income to enable consumers to purchase the goods produced. He places major responsibility on business booms, and argues that profits are necessary to stimulate production. He reviews the operation and effect of booms, but is inconclusive as to the causes of booms, and he fails to meet the arguments of Foster and Catchings as to the distribution of profits. He intimates that the injection of credit money into circulation will enable producers to continue buying, but again does not entirely refute Foster and Catchings' argument that the spending of unearned money promotes a vicious cycle.

It is to be expected that on such an intangible subject there will be a wide divergence of opinion between economists, but if a solution is to be found for the alternate boom and depression periods in our industry it can only be done through study by industrial leaders and economists. This book adds much to the discussion of this important subject, and as such makes a valuable addition to the library of any one interested in the bettering of industrial conditions.

Cutting and Soluble Oils

By H. L. KAUFFMAN
Consulting Petroleum Chemist and Lubricating Engineer

Soluble oils are the best coolants for machine-tool cutting operations—Nature of the oils and methods employed in their preparation—Suggestions for their use

WATER-SOLUBLE oils are manufactured compounds which, when mixed with water, form permanent emulsions or oily solutions. The amount of water mixed with any soluble oil varies with the nature of the work and the characteristics of the soluble oil. Water emulsions made by mixing a soluble oil with water are more effective in cooling the tool and the work than are the straight cutting oils. This is because water has the highest specific heat of any liquid, and will therefore absorb more heat; hence such emulsions are better coolants than other types of cutting lubricants. If properly made, water emulsions formed from soluble oils have a high lubricating value. Also, they are much less expensive than compounded cutting oils. Cutting emulsions are very fluid. They are therefore most useful where an exceptionally great amount of heat is generated at the cutting edge. If the solution has been properly made, the machined part will have a smooth finish. However, if a poor grade of soluble oil is used in making the water emulsion, or if too dilute a solution is made, rusting may take place. The milky white emulsion formed when a soluble cutting oil is mixed with water should be liberally supplied on the cutting tool at the point of contact. The water in it keeps the tool cool by absorbing the generated heat and carrying it to the larger volume of liquid, where the heat radiates either to the air, or to the walls of the settling tanks. The oil, in turn, acts as a lubricant by penetrating to the cutting edge, from which point it carries away the chips and turnings. Thus, the digging in and tearing of the metal by the tool is prevented. In addition, the oil makes possible a smooth finish to the work and so distributes itself over the metal as to form a protective coating which prevents oxidation or rust.

It is not practical for the average shop without a laboratory to prepare its own cutting oil bases, but a knowledge of the ingredients and methods of manufacture will help in understanding their proper application to the work at hand, and enable the shop to obtain the best results

Water-soluble oils can be divided into two principal divisions, the soap-base type, and the sulphonated oil type. Soluble cutting oils containing a water-soluble soap are made by mixing a soluble cutting base with mineral oil, usually in the ratio of from 75 to 80 per cent of mineral oil with from 20 to 25 per cent of the cutting oil base. The proportion of base to mineral oil to be used in manufacturing a soluble cutting oil depends primarily upon the quality of the oil desired. Either 28 or 25 deg. pale paraffin oil, or a 150 to 200 viscosity at 100 deg. F. low cold test oil, are the grades of mineral oil that usually are used in the preparation of the soluble oil. This oil is then mixed with water to form the cutting emulsions in varying proportions, depending upon the operating conditions. The formula and procedure followed by one large manufacturer in making a cutting oil base is to break up 869 lb. of hard rosin and add to the soluble oil base, after which 340 lb. of 180 proof denatured alcohol is added. Next is run into the kettle a solution of caustic soda made by dissolving 112 lb. of flake lye in 230 lb. of water. The kettle is now sealed tightly by placing plaster of Paris around all of the joints and around the man-hole in order to prevent the escape of the alcohol vapors. Steam is turned into the jacket of the kettle for from 5 to 6 minutes, and the jacket immediately thereafter is blown clear, for the reaction from this point on proceeds without additional heat. A small pipe runs from the top of the kettle connecting to a small water-cooled reflux condenser placed above the kettle. Any alcohol that rises to this point as a vapor will be condensed and will drip back into the kettle.

Agitation of the contents of the kettle with the mechanical stirrer is started as soon as possible after the kettle has been sealed. However, it sometimes happens that stirring is impossible until the bottom of the kettle becomes warmer and the lumps of hard rosin are partially melted. After stirring for a short period of time the batch can now be allowed to remain undisturbed for 5 or 6 hours, the heat of the reaction being sufficient to keep the contents of the kettle hot.

A sample is taken from the batch after the reaction has proceeded for 6 hours and is tested in the chemical laboratory for percentage of free caustic soda. The experience of this particular manufacturer has been that best results are obtained from the finished product if the sample from the batch at this time shows between 0.15

The second article. The third will appear in an early issue.

and 0.3 per cent of free alkali. Otherwise the batch must be corrected by the addition either of more rosin or caustic soda, depending upon the results of the test. The reason for desiring a small percentage of free alkali in the mixture at this time is so that a small amount of sodium oleate will be formed when elaine oil later is added. Eight hundred pounds of elaine oil, commercial oleic acid, is added to the kettle after making such corrections as were necessary so as to have present approximately 0.2 per cent of free alkali before the addition of the elaine oil. The cold elaine oil is added through a small hole in the top of the kettle. This hole is fitted with a cap that screws down tightly so that no vapors are lost through it.

Agitation is continued for an hour after the addition of all the elaine oil. If a sample from the batch now meets the laboratory emulsification test, the base is cooled by circulating water through the jacket of the kettle, and when cold, is drawn off into barrels. The base is never drawn at a temperature of over 100 deg. F. The product is screened through at least four thicknesses of cheese cloth to remove grit or other impurities before it is allowed to pass into shipping containers.

Emulsification Test

The laboratory emulsification test is made by this manufacturer in the following manner: The soluble oil is made by mixing the cutting oil base with a low cold test red oil, having a viscosity of 200 at 100 deg. F., in the ratio of four parts of mineral oil to one part of base. Then 150 cc. of soluble oil prepared in the manner just described is mixed thoroughly with 870 cc. of distilled water and the whole poured into a 1,000 cc. Florence flask. If after standing over night there takes place a separation of any appreciable amount of oil from the emulsion, more alcohol or water is added to the original cutting oil base until the proper amount of solvent is shown to be present. The experience of this manufacturer has been that if a soluble oil when mixed with water turns white the moment the oil touches the water it is in good condition. Furthermore, those soluble oils that pass down through the water as oils and then afterwards turn white almost always fail to form permanent emulsions, but show the separation of oil after standing. In making the laboratory emulsification test experience has shown that most of the separation of the oil takes place during the first three hours that the emulsion stands in the flask. Hence, an indication is obtained at the end of that period of time as to the quality of the cutting oil base.

In correcting a sample from the batch in the laboratory by the addition of either more alcohol or water or both, the customary procedure is to make trial experimental blends by adding either alcohol or water, or mixtures of the two, to the cutting oil base in 0.5 per cent proportions until the proper equilibrium as demonstrated by the stability of the emulsion is obtained. From the laboratory results of the correction it is necessary to make in order to obtain the most stable emulsion, it is an easy matter to calculate the amount of alcohol or water to be added to the main batch of cutting oil base. The addition of this small amount of solvent after the completion of the batch usually is necessary because of the evaporation that takes place due to the fact that the kettle cannot be made perfectly tight.

Four different formulas for making water-soluble oils of the soap base type that have proved fairly satisfactory are here given for use as the basis for making experiments in an effort to develop an even more satisfactory water-soluble oil.

Formula No. 1—Mix No. 1, mineral oil 9 gal.; rosin oil 1 gal.; oleic acid 1 gal. Mix the above with heat. Dissolve 4 oz. of sodium hydroxide in 1 qt. of water and 1 qt. of alcohol. Mix 1 and 2 together.

Formula No. 2—Mix No. 1, rosin oil 29 parts; oleic acid 7 parts. Mix No. 2. Dissolve 2 parts of sodium hydroxide in 2 parts of water and add 6 parts of denatured alcohol. Stir No. 1 and No. 2 mixtures together and then add 54 parts of mineral oil.

Formula No. 3—Rosin oil 280 lb.; mineral oil 400 lb.; oleic acid 64 lb.; denatured alcohol 8 gal.; 26 deg. ammonia 3 gal. Mix one part of the above with 5 parts of water.

Formula No. 4—Mix No. 1, mineral oil 9 gal.; oleic acid 1 gal.; carbolic acid 1 lb. Mix No. 2. Dissolve 10 oz. of potassium hydroxide in 1 qt. of alcohol and 1 qt. of water. Mix No. 1 and No. 2 together.

Sulphonated oils are frequently used as bases in the manufacture of water-soluble cutting oils. Fixed oils are sulphonated by being treated with sulphuric acid, the excess acid thereafter being washed out, and only that which is chemically combined with the glycerine is allowed to remain. After the sulphonated oil has been prepared, it is blended either directly with mineral oil or a soap is made of the sulphonated oil by saponifying the oil with an alkali such as sodium, potassium or ammonium hydroxide used either singly or in combination. Castor oil and corn oil are the vegetable oils which can be sulphonated so as to give a resultant product that has the most desirable characteristics for use as a cutting oil base, although other fixed oils can also be used. A formula for making a cutting emulsion containing a sulphonated oil is here given. The figures are percentages by weight.

Non-viscous mineral lubricating oil (80-100 viscosity at 100 deg. F. 17.54; elaine oil (commercial oleic acid) 7.89; 10 deg. Be. caustic soda solution 4.39; sulphonated castor oil 39.45; water 30.73; total 100 parts.

The Compounding Process

The mineral oil is first mixed with the sulphonated oil and then, agitating constantly, the solution of caustic soda is added to the mixture of oils. When entirely mixed the whole is brought to a boil, after which it is allowed to stand for at least 10 hours before it is mixed with water. Many compounders and marketers purchase cutting oil bases from manufacturers who specialize in making such bases, in which case it is a simple matter for the compounder to blend up the base with mineral oil to make a marketable water-soluble oil.

Water emulsions formed from soluble oils are much more effective in cooling the tool and the work, and are much less expensive than other types of cutting lubricants; hence they are used quite widely for a variety of purposes. Such water emulsions, if made from well-manufactured water-soluble oils, are suitable for use in such cutting operations as lathe work, bolt and nut work, automatic screw machine work, drilling, milling, gear cutting, slotting, punching, or grinding. In addition to their use in metal cutting and punching operations, water-soluble oils are also frequently used in the textile industries where the oil must be washed out clean after printing or similar operations.

Cutting emulsions made from water-soluble lubricants are especially suitable for use in operations involving deep pressing in soft steel, more particularly where the work after being fabricated must be cleaned or enameled. Cutting emulsions meet the requirement of quick removal better than any other type of lubricant, and hence their use is preferable for this purpose. However, care must be taken to determine the proper amount of water to be mixed with the soluble oil in order to obtain the cutting emulsion that proves most satisfactory; for the ratio of water to oil in order to obtain the best cutting emulsion is apt to vary with each cutting operation. Another operation in which water emulsions made from soluble cutting oils prove successful is in lubricating and cooling the work in sheet metal punching and drawing operations.

In general, it may be said that it is best to use a water-soluble oil where conducting the heat away from the work is of primary importance; as, for example, in heavy cutting, milling, or stamping operations; or in drilling at a high rate of speed where the principal duty of the cutting lubricant is to wash the chips out of the holes and to keep the nose of the drill at a low temperature, in addition to furnishing lubrication at the cutting points and surfaces. Water-soluble cutting lubricants of good quality should be free from disagreeable odors, mineral acids, and any ingredients that are injurious to the hands of the workman. They should form a stable emulsion when mixed with water, should be free from corrosive action on polished metal, and should show no tendency to leave a sticky residue after being in use.

Musings of An Old-Timer—Discussion

By James C. Harper
Glasgow, Scotland

ON PAGE 781, Vol. 66, of the *American Machinist* there appears under above title some valuable truths. There is, however, one statement that, in the writer's opinion, is subject to qualification, namely—"A clock watcher makes a poor fit in any machine shop."

Most of us have, at some time or other, come across that type of individual whose chief thought when starting work of a morning is to see how quickly the hands of the clock go 'round until at last along comes stopping time. But isn't there another type of "clock-watcher?"

What of the worker who is continually endeavoring to beat the clock, the worker who is always striving to see how *slowly* he can make the hands go 'round. To achieve this he must always be endeavoring to knock just another second or so off the time for doing the job. From personal experience the writer has found that there is nothing quite like clock watching of the latter type for keeping one working at top pressure throughout the day. Again, whether the operation may be of short or long duration, the hands of the clock leave no doubt in the mind of the operator as to whether or not he is making progress on a job. The writer has always found it advisable to have the clock in such a position that it can be seen by every operator from his machine. Provided the men are paid by results, clock watching will help to improve output considerably.

Motion study helps to cut down time by eliminating all unnecessary movements. Clock watching serves as another aid to production by showing the operators when they are making the hands go slowly.

Seen and Heard

By John R. Godfrey

A heat-treating wizard—Chilled-iron wearing surfaces

THERE'S no accounting for men's developing in various directions. Some lean toward very fine work like watches and other minute pieces where the magnifying glass is necessary at all times. Others are sharks at planning and erecting huge buildings or machinery. The leanings of one of my good friends are toward heat-treating. He was inoculated years ago, in the early days of high-speed steel, and he's developed into a high-grade wizard when it comes to heat-treating problems.

He seems to have an uncanny instinct that tells him what to do and how. If you have bored a hole a trifle too small— he can bring the hardened piece out of the bath at the size you want, within the expansible properties of the steel, of course. Some say he knows the language of steel and just "talks to it." At any rate he gets results, if the flow of business to his little shop is any criterion.

For, while I usually think of heat-treating as being a local business, he gets work from as far as 2,000 miles away. Not the ordinary run of hardening that almost any one can do, but both heat-treating and hardening of certain parts. Such as expensive dies, on which several hundred dollars have been spent, come to him with the assurance that they will be hardened safely and right. And like most specialists, he probably doesn't charge enough for his services, which mean a lot more than the actual time put in on the work. He should receive ample recompense for the "know how"—for the years of experience that enabled him to secure the desired results.

* * * *

We are learning so much about new steels and new alloys that we sometimes forget the good points of the materials that served us well in the days when steel was replacing wrought iron in machine building. Chilled cast iron for example, dates away back in the dark ages of machine work. Car wheel treads have been chilled for more years than most of us realize. Before the days of high-speed steel, we used to have spasms of using turning tools of cast iron with the cutting ends chilled. And they frequently gave a good account of themselves in the wheel lathes of thirty years ago, on locomotive tires—which are not easy things to turn even with high-speed steel. If anyone doubts that chilled iron is really hard—just let him try a few real experiments with it.

An example came to light the other day. A cam-actuated mechanism gave a little trouble from excessive wear of the surface against which the cam acted—sometimes as much as 1,500 times a minute. Alloy steels of various kinds, containing nickel, chromium, tungsten, molybdenum, etc., were tried, with different heat-treatments and with varying success, none of them proving entirely satisfactory.

Then one of the old timers harked back to his boyhood and suggested that chilled cast-iron be tried. Which, to make a long story short, did the trick and is still being used. It outwore any material they had tried and did not show any bad effects on the cams.

Liability of Lessee for Damages by Fire

By Lester Childs

THE question of the liability of the lessee of property for damage by fire thereto, caused by negligence or a lack of care in the occupancy of the property, is one of importance to both property owners and lessees. And, in particular is this true where industrial property is involved and is leased to be used in manufacturing processes where fire hazards to some extent, are bound to be present.

The subject is one of some difficulty, and the court decisions thereon are not precisely in accord. However, this much may be said: By weight of authority, a lessee will be liable for damage by fire, if caused by his negligence, in the absence of a clear stipulation in the lease to the contrary. And further, the mere presence of a general exception of a lessee from liability for damage by fire in a lease, as is frequently inserted, may not be used to excuse the lessee if the fire is shown to have resulted from negligence.

An Actual Case

The application of this rule is illustrated in a number of cases, and among them is found the Washington case of Carstens v. Western Pipe and Steel Co. In this case the steel company leased certain water front premises from Carstens to be used for manufacturing purposes. The lease was in writing and contained, among other things the following stipulation:

"At the expiration of the term hereof the said lessee will quit and surrender the said leased premises in as good state and condition as when possession is taken, *damage by the elements or fire excepted.*"

The steel company had a contract to furnish the city of Seattle with iron pipe that had to be treated with an asphalt derivative. For this purpose the lessee installed on the leased premises a large iron tank for use in dipping the pipe in the preparation. This dip tank was placed within a furnace made of concrete and lined with fire brick, and the furnace was heated by oil piped from a tank some little distance from it.

During the night it was customary to cook the preparation used for treating the pipe and a watchman was kept on the premises to take care of the furnace and see that the preparation was properly heated. While the lessee was thus using the premises, a fire broke out one night and damaged the leased property as well as other adjoining property, which was also owned by the lessors. The latter thereafter brought action to recover against the lessee on the ground that the fire was caused by its negligence.

In defense, the lessee, among other things, contended that the provision in the lease relieved it from liability for damage or loss caused by fire, regardless of how the fire originated. Upon the trial of the case, the jury returned a verdict of $9,000 against the lessee. The trial court, however, declined to let this stand, and granted a new trial. From this ruling the lessors appealed, and the higher court in reviewing the record in respect to the sufficiency of the evidence to show negligence on the part of the lessee, in part, said:

"The testimony is clear that the fire started at the furnace. When the watchman turned off the oil and left the tank the Satco was at a heat of about 350 deg. to 375 deg. The fire brick were red hot. There was testimony to the effect that the flange of the kettle which rested on the upper part of the concrete portion of the furnace did not fit securely, and that drippings of the Satco would go between the kettle flange and the inner wall of the furnace, and thus onto the fire brick and down into the fire pit. . . . Under all the testimony and the circumstances we do not feel justified in holding that the evidence as to negligence wholly failed. . . ."

Following the above disposition of the negligence phase of the case, the court turned to the contention of the lessee that the exemption clause in the lease relieved it from liability. In passing upon this point, the court said:

"The thing for us to do is to determine what the parties to the lease had in mind when they provided that the leased property was to be surrendered in good condition, damage by fire excepted. Did that clause mean that the lessee was to be relieved from fires which were the result of its own negligence? We ought not to come to that conclusion, unless the lease definitely and certainly so expresses itself.

Stipulation Must Be Clear

"It would be natural and customary for the lessee to want to escape liability for purely accidental fires and for the lessors to be willing to grant that relief, but it would not be natural that the lessors would be willing to release the lessee from damages caused by its own active negligence. Such a concession would hardly be looked for in a contract between business men. If the parties intend such a contract we would expect them to so state in clear terms. . . . The order of the court granting a new trial is reversed, and the cause remanded, with directions to enter a judgment on the verdict."

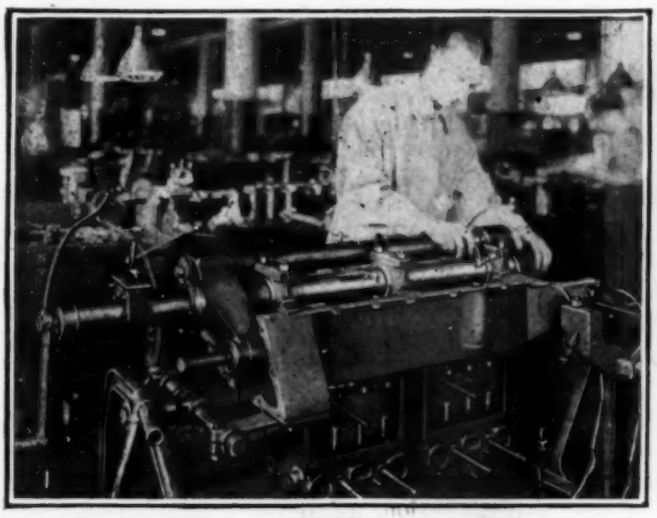
In other words, to confer exemption from liability for damage caused by negligence, the stipulation to that effect would have to be plain, clear, and directly on the point.

A Serial Number With a Meaning —Discussion

By Edwin L. Plummer

ON PAGE 1982, Vol. 66, of the *American Machinist*, W. J. Outcalt finds objection to the example previously given by Mr. Merry in that the number may be duplicated at a later date. I have had experience with a similar system of order numbers, in which this objection is overcome. In this system the first ten months are denoted by the ten digits, the naught being used to represent 10 for October. November and December are represented by their initial letters. The next two figures of the serial number represent the day of the month, the next two the year, making, in all, five figures for the date. The figures following these represent the number of the order for that particular day. For example, the fifth order on the date, August 2, 1927, would be 802275. Though this number might be duplicated on Aug. 2, 2027, the time is so remote that it would not be likely to affect many of use.

Automotive Production



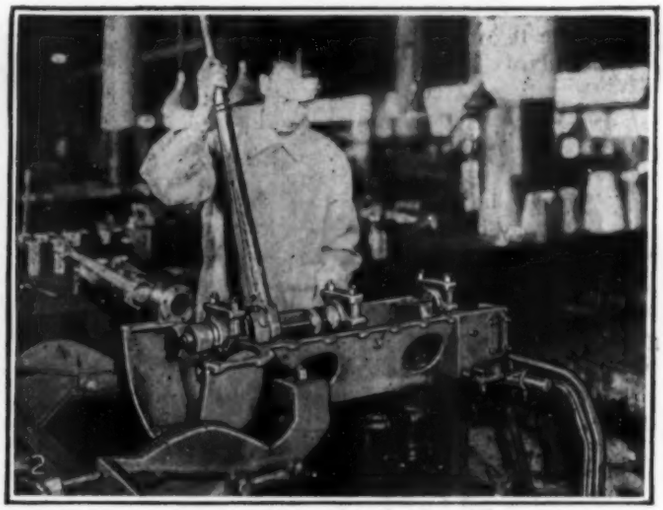


Fig. 1—Setting cutters in boring bar for boring main bearings. The bar is held at each end in a substantial arm that is located from the camshaft hole so as to maintain correct center distances. Fig. 2—Facing end of rear bearing with special tool to provide proper end play of shaft. This tool contains guides that go inside the bearing, and an adjusting screw that feeds the cutters into the work

Mack Methods of Overhauling Bus Engines

THE average time for overhauling a Mack AB bus engine of the four-cylinder type, 4½x5-in. cylinders, is given as 110 hr., divided about as follows:

Remove and replace engine in chassis; 18 hr. A portable crane is used for this work as can be seen in Fig. 12. This not only saves the heavy labor of lifting but also prevents damage to engine or chassis, and possible injury to men, should it slip in handling.

Overhaul engine; including regrinding of cylinders and crankshaft, boring bearings and adjusting and cleaning valves; 75 hr. The usual methods of regrinding cylinders are used, the work being done on a Heald grinder. The crankshaft is reground, if necessary, on a regular grinding machine. The use of a casehardened crankshaft has reduced the wear and consequently the regrinding necessary. Fewer crankshafts are worn sufficiently to require regrinding, than when alloy-steel crankshafts are used. The straightening is done as in Fig. 5, when necessary.

The boring and facing of the bearings are done with special tools and fixtures as seen in Figs. 1, 2, 3, 4 and 6 while Figs. 7 and 8 show the boring of the connecting rod and the way in which it is tested for squareness. In Fig. 9 can be seen the method of handling valve springs.

Carburetor overhaul; 2½ hr. There are no special methods except that for testing the carburetor float-valve with gasoline from a pressure tank above as in Fig. 13. This method gives a test that approximates actual conditions, but with an excess of pressure.

Magneto overhaul; 3 hr. The work consists of the usual cleaning and inspection of contacts.

Starter and generator overhaul; 3½ hr. Here again the usual methods are followed. Commutators are trued if necessary, connections are inspected and the capacities of both units are tested in the usual manner.

Supervision and inspection, or time of foreman, tester and inspector, in deciding what parts shall be replaced; in checking the assembly; in tuning up and in road test; 8 hr. Since much depends on the thoroughness with which these inspections are made and the tests carried out, there is no limit placed on the time taken in each case, the eight hours being merely an average that has been found advisable in order to secure good results. The clearances that have been found to give good service and are therefore recommended, will be found in a compact and convenient table at the bottom of the last page of illustrations. Careful attention to securing these clearances will increase time between overhauls.

Automotive Production

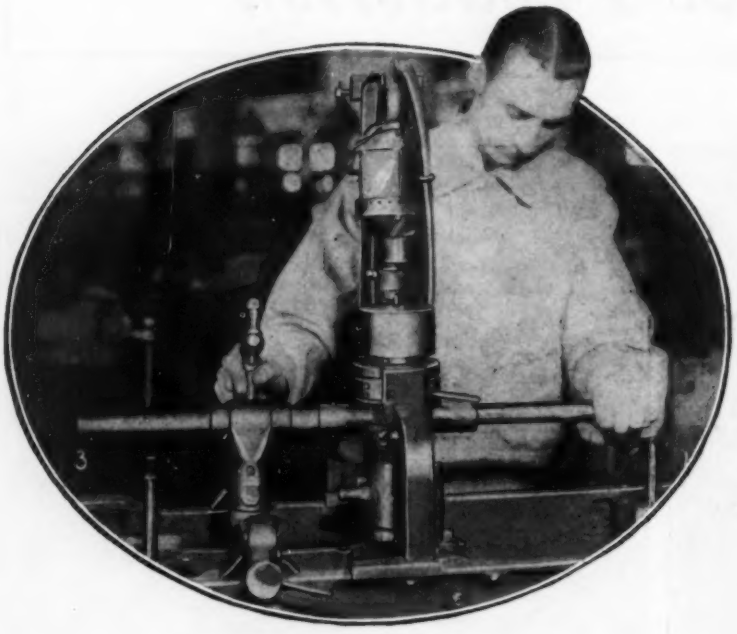
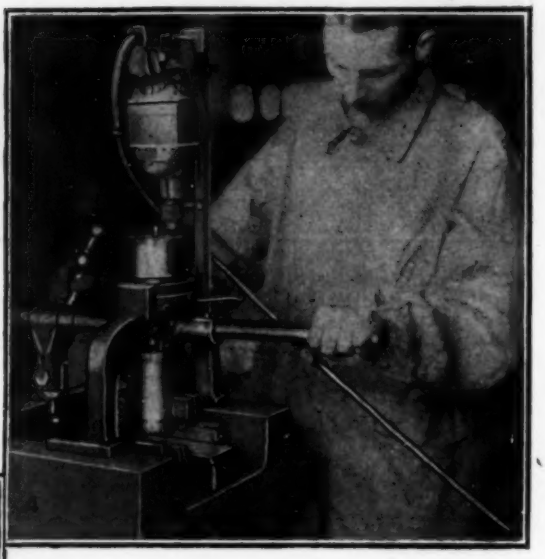


Fig. 3—Special tool for milling the face of the bearing joint after the bearing is in the crankcase. The facing tool is driven by a portable electric drill mounted on part of the frame of the machine. The cutter is fed along the bearing by the screw at the left

Fig. 4—Using the same device as in Fig. 3 to face the bearing caps before assembling. The cap is held in place by the strap shown and the cars of the cap are properly supported



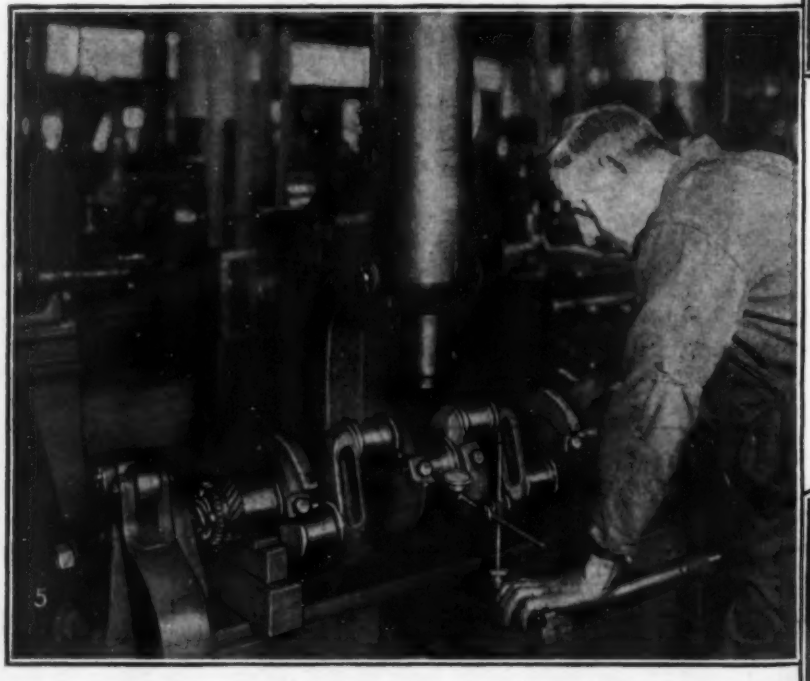
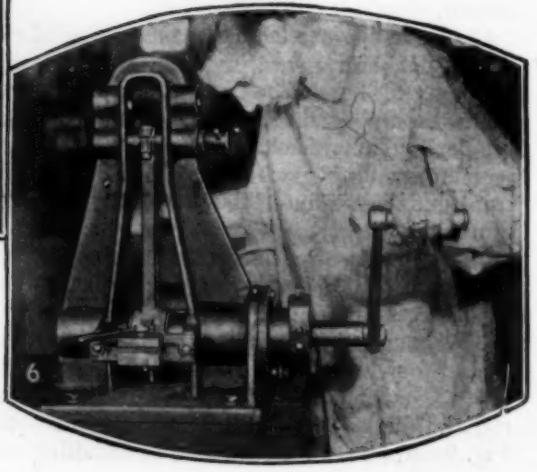


Fig. 5—Straightening a crankshaft under a small hydraulic press. The shaft is tested by the dial indicator shown and is adjusted until it runs true. The method of attaching the counterweights is shown

Fig. 6—Fixture for boring large-end bearing in connecting rods. The feed screw is shown at the right end of the fixture. A single-point, fly cutter is used. This fixture handles two lengths of connecting rods



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Photographs by courtesy of the International Motor Co., Long Island City, N. Y.

Fig. 8—Testing squareness of connecting rod. A feeler is used between ends of the test bar and the stops on the fixture

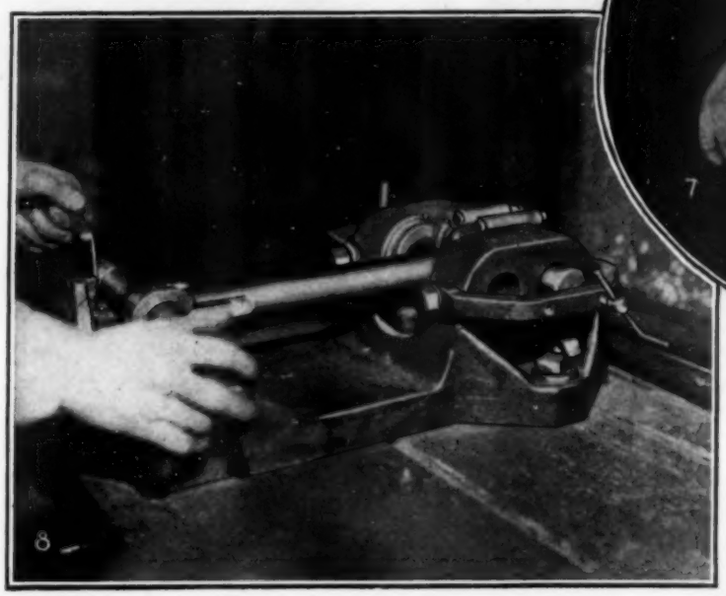


Fig. 7—Facing ends of connecting rod bearing. The facing tool is held in a vise and the rod is turned by hand while the cutters are adjusted to the proper position

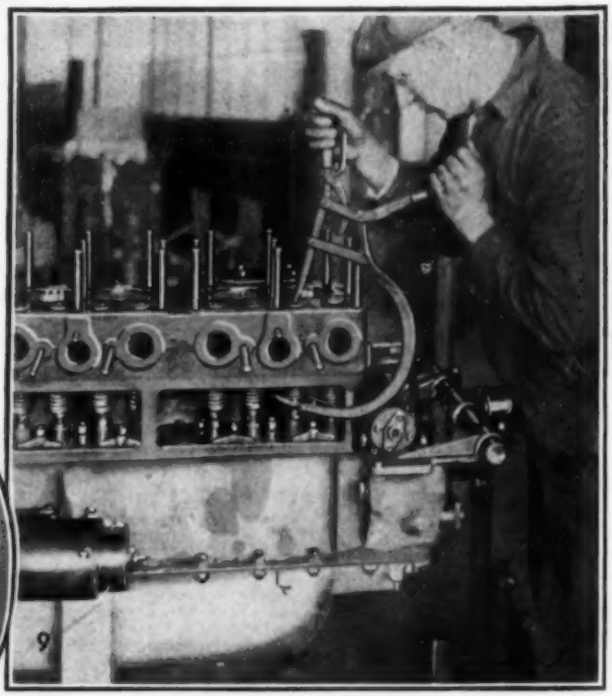


Fig. 10 — Air-operated valve grinding tool. Has automatic reverse in the tool itself

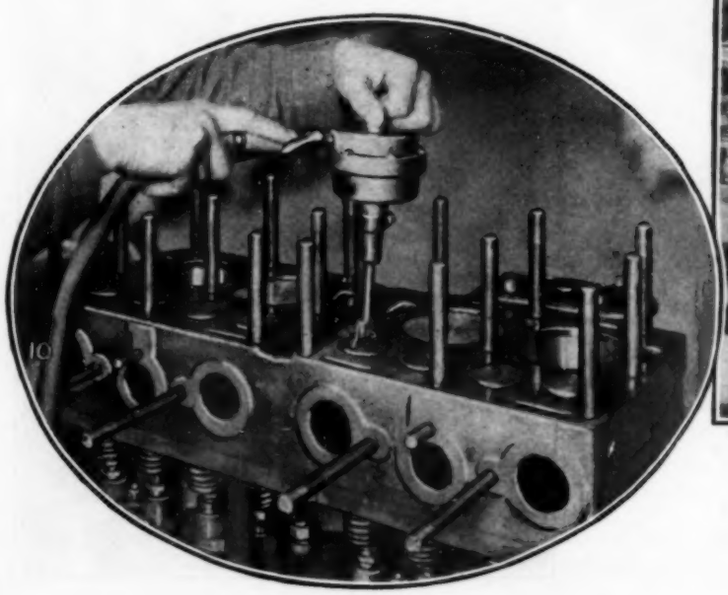


Fig. 9—Tool for compressing valve springs while removing pins. It is easy to operate, owing to the leverage and it can be held in any position

Automotive Production

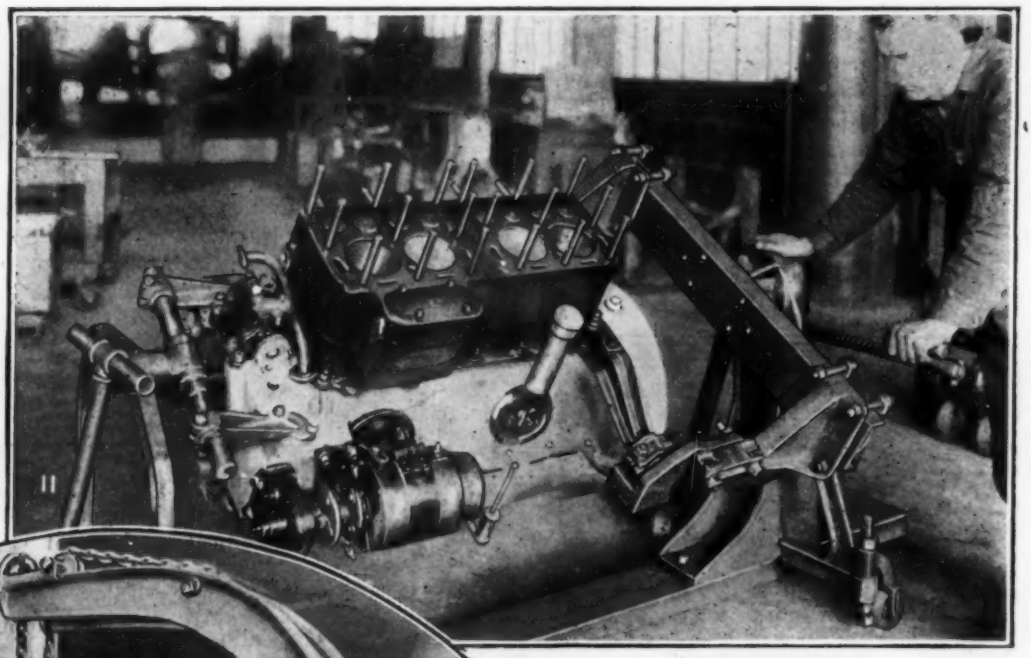


Fig. 11 — Worm-gear-operated assembly stand. It holds the engine in any position and is easily handled

Fig. 12—Lowering the engine into the chassis with portable crane. Saves lifting and prevents damage from slippage

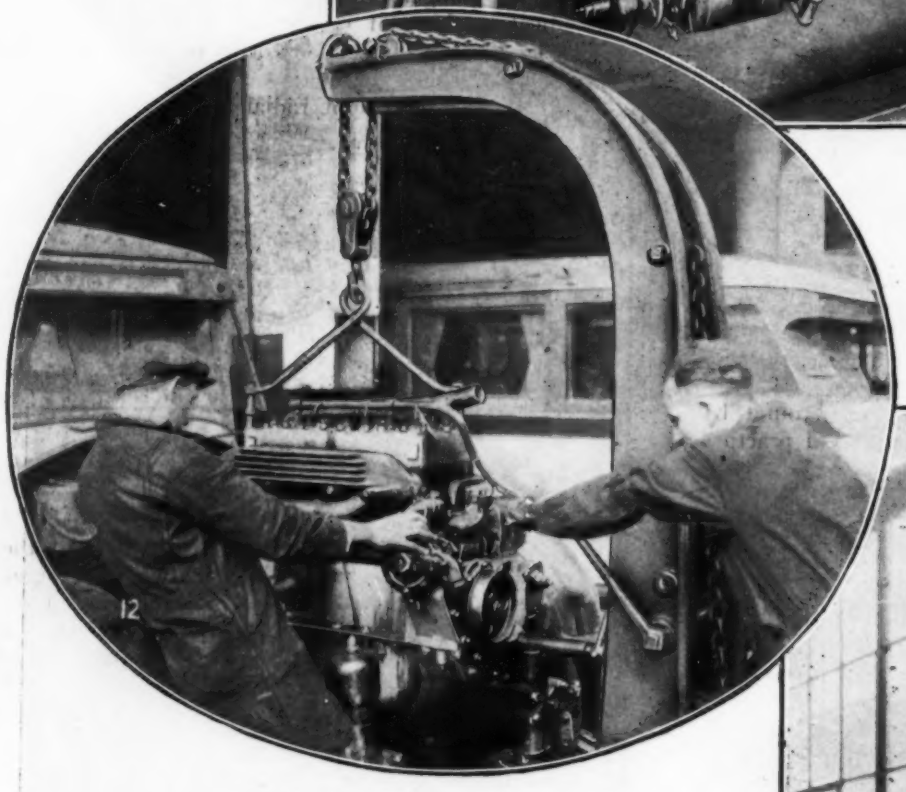


Fig. 13—Testing carburetor float valve with gasoline from pressure tank. The carburetor is tested under actual working conditions with an excess of pressure

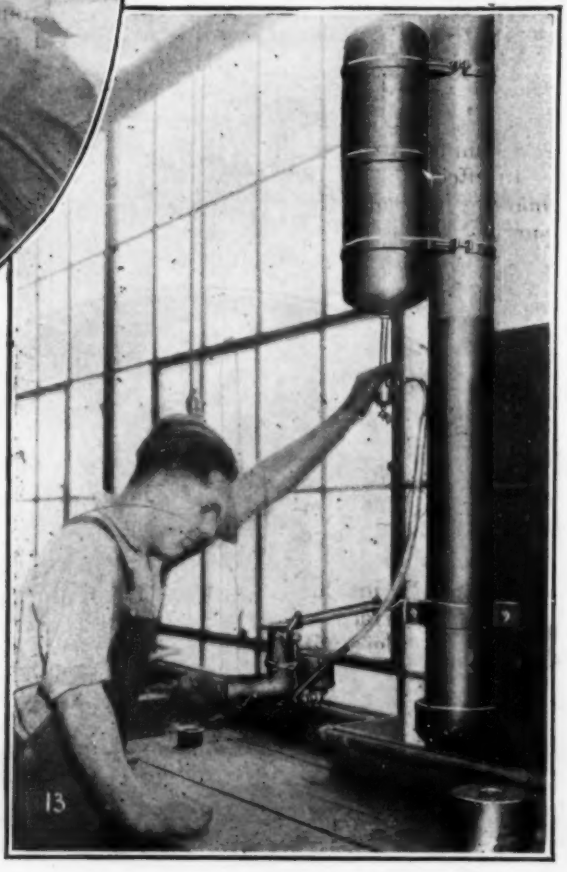


Table of Clearances

Part	Clearance, Inches
Bearings:	
Connecting-rod diameter	0.001
Side	0.003
Main crankshaft diameter	0.001
Middle (each side)	0.0025
End (inner face)	0.005
End (outside)	0/015 up to 1/64
Camshaft	0.002
Fan, end play	0.020
Pump shaft	0.002
Cross-shaft and gear, end	0.002
Cylinder parts	
Piston (skirt to cylinder)	0.008
Piston ring gap	0.008
Side	0.001
Piston pin bushing	0.0005
Inlet tappet	0.020
Exhaust tappet	0.025
Stem and guide inlet	0.002
Exhaust	0.006
Lifter and guide	0.002
Lifter roller and pin	0.0005

Machining and Measuring Gear Teeth

By EARLE BUCKINGHAM
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Calculation of setting angles of tools for cutting involute helicoidal relief surfaces on hobs with radial flutes—Modification with helical flutes—Distortion of profile with undercut flutes

Thus far we have considered only the cutting edges of gear hobs. These edges must lie in an involute helicoidal surface. In order to be effective cutting tools, the material back of these cutting edges must be relieved. The correct forms of these relieved surfaces depend upon the amount of relief and the character of the cutting flutes; that is whether they are straight or helical, radial or undercut. We will first examine the relieved surfaces of hobs with straight radial flutes.

Whenever the correct profile of the hob is in axial section is a very close approximation to a straight line (which occurs when the helix angle of the hob is small), the ordinary radial relief is near enough correct to use. In all other cases such a relief will introduce errors such that the gears cut when the hob is new will be different from those cut after the hob has been ground back appreciably. This error can be reduced and practically eliminated by making the relief surfaces of involute helicoidal form. Incidentally, if these relieved surfaces are ground, the involute helicoid is the simplest one to maintain to any specified degree of accuracy.

In effect, the introduction of relief on the sides of the hob teeth results in making one side of the relieved surface with a slightly greater lead than that of the cutting edges while the other side has a correspondingly lesser lead. The intersection of these two different helicoidal surfaces with the surface of the cutting flutes should be identical with the intersection of the correct (theoretical) involute helicoidal surface of the cutting edges with this same surface of the cutting flutes. In general, where the relieved surfaces are of involute helicoidal form, if the tangents of these intersection curves are identical to those of the helicoidal surfaces of the cutting edges, these intersection forms will be practically identical.

The surface of a straight radial cutting flute lies in the axial plane of the hub. Without relief, the correct profile would be developed by setting a cutting tool with an angle equal to that of the generatrix off center an amount equal to the radius of the base cylinder of the helicoid. In Fig. 54, this is illustrated.

The same conditions can also be maintained when grinding such surfaces with a cone-shaped grinding wheel. In this case the axis of the wheel is set at any convenient angle in the horizontal plane and trued in position to the angle of the generatrix. This wheel is also set off center the same amount as for the cutting tool. In Fig. 55, this is illustrated.

When involute helicoidal surfaces are used for the relieved surfaces, the radius of the base cylinder and the angle of the generatrix for these surfaces with changed leads, one greater and the other less than that of the cutting edges, can be calculated. These two values give all the data necessary to set these relieving tools properly. Due to the horizontal contact line between these tools and the hob surfaces, a straight-in relieving action does not make it change its horizontal position, hence the true involute helicoidal surfaces will be produced. Also because of the same reason, the diameter of a grinding wheel thus located has no effect on the form produced. With any other setting where the contact line is not horizontal, or on any type of helicoid except the involute helicoid, a change in the diameter of the

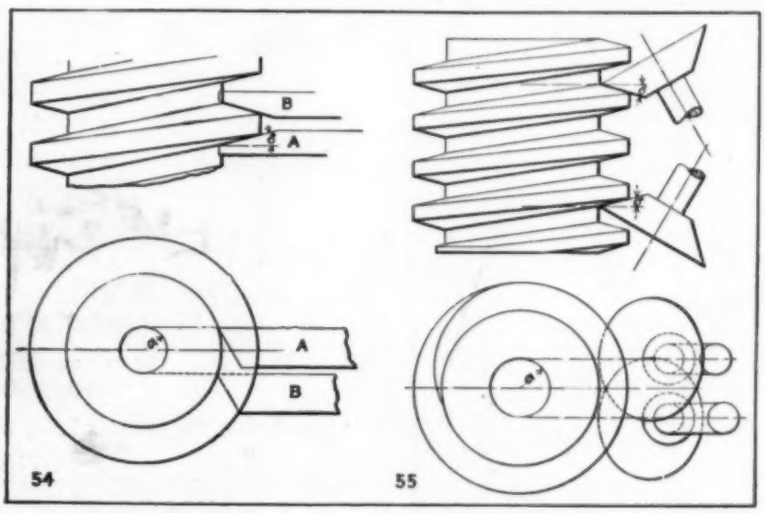


Fig. 54—Setting of cutting tool for hob without relief. Fig. 55—Grinding a hob without relief with a cone-shaped wheel

The eighth article. The ninth will appear in an early issue.

grinding wheel will also change the form of helicoid produced.

We will now determine the change in lead on the relieved surfaces of a hob. Considering first one with straight radial cutting flutes, we have:

When K = lead of hob
α = pressure angle of basic rack
α'' = angle of tangent to profile on axial section at R
R = pitch radius of hob
β = helix angle of R
N = number of cutting flutes
F = radial relief of hob per flute.

The leads of the relieved surfaces of the hob teeth would then be as follows:

$$\tan \alpha'' = \frac{\tan \alpha}{\cos \beta}$$

$$\text{Greater lead} = K + NF \tan \alpha''$$

$$\text{Lesser lead} = K - NF \tan \alpha''$$

We will now determine the radius of the base cylinder and the angle of the generatrix of the involute helicoids with these changed leads, assuming that the tangents (at the pitch radius) to the curves formed by the intersection of these helicoids with the straight radial surfaces of the cutting flutes are the same as the tangents to the theoretical cutting edges at the same point. Thus, when

K' = greater lead
K'' = lesser lead
α_1 = basic rack for greater lead
α_2 = basic rack for lesser lead
β' = helix angle on greater lead at radius R
β'' = helix angle on lesser lead at radius R
δ' = angle of generatrix on greater lead
δ'' = angle of generatrix on lesser lead
a' = radius of base cylinder for greater lead
a'' = radius of base cylinder for lesser lead.

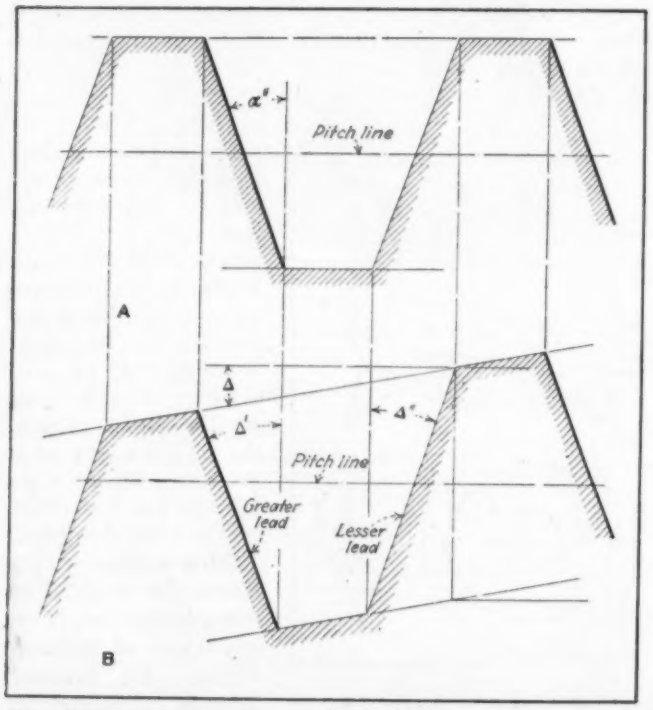


Fig. 56-A—Axial section of helicoid containing cutting edges. B—Axial section of relieved surfaces

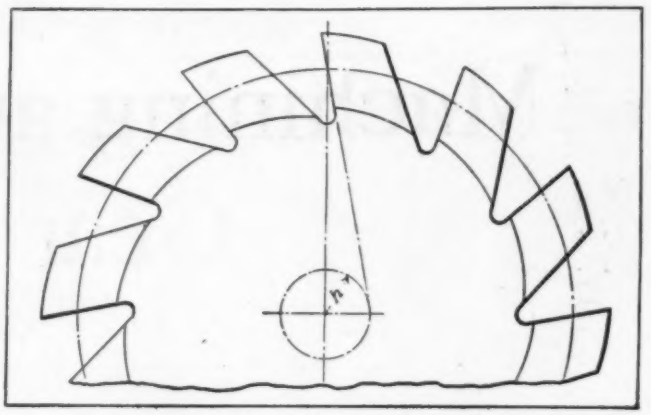


Fig. 57—Hob with undercut flutes

It must be remembered that the circular pitch of these relieved surfaces remain unchanged because of the jumping action of the relieving tool. Also that α'' is to be the same for all surfaces. We have therefore:

$$\tan \beta' = \frac{K'}{2\pi R} \quad \text{and} \quad \tan \beta'' = \frac{K''}{2\pi R}$$

$$\tan \alpha_1 = \tan \alpha'' \cos \beta' \text{ and } \tan \alpha_2 = \tan \alpha'' \cos \beta''$$

$$\cos \delta' = \cos \alpha_1 \cos \beta' \text{ and } \cos \delta'' = \cos \alpha_2 \cos \beta''$$

$$a' = \frac{K'}{2\pi \tan \delta'} \quad \text{and} \quad a'' = \frac{K''}{2\pi \tan \delta''}$$

As a definite example, we will consider a 6-D.P. hob, $14\frac{1}{2}$ deg. pressure angle, 3-in. pitch diameter, with 15 straight radial cutting flutes, and with 0.050 in. radial relief (top rake) per flute. This gives us the following values:

$$P = 0.5236 \text{ in.}$$
$$R = 1.500 \text{ in.}$$
$$\alpha = 14\tfrac{1}{2}^\circ$$

$$\sin \beta = \frac{2\pi R}{P} = \frac{M}{2R} = \frac{1}{6 \times 2 \times 1.500} = 0.05556$$

$$\beta = 3^\circ\ 11'\ 5''$$
$$N = 15 \text{ flutes}$$
$$F = 0.050 \text{ in. per flute}$$

$$K = \frac{P}{\cos \beta} = \frac{0.5236}{0.99845} = 0.52441 \text{ in.}$$

$$\tan \alpha'' = \frac{\tan \alpha}{\cos \beta} = \frac{0.25862}{0.99845} = 0.25902$$

$$\alpha'' = 14^\circ\ 31'\ 15''$$

$$\cos \delta = \cos \alpha \cos \beta = 0.96815 \times 0.99845 = 0.96665$$

$$\delta = 14^\circ\ 50'\ 15''$$

$$a = \frac{K}{2\pi \tan \delta} = \frac{0.52441}{2 \times 3.1416 \times 0.26491} = 0.31503 \text{ in.}$$

$$K' = K + NF \tan \alpha'' = 0.52441 + (15 \times 0.050 \times 0.25902) = 0.71868 \text{ in.}$$

$$K'' = K - NF \tan \alpha'' = 0.52441 - (15 \times 0.050 \times 0.25902) = 0.33014 \text{ in.}$$

Considering the greater lead, we have:

$$\tan \beta' = \frac{K}{2\pi R} = \frac{0.71868}{2 \times 3.1416 \times 0.26491} = 0.07625$$

$$\beta' = 4^\circ\ 21'\ 37''$$

$$\tan \alpha_1 = \tan \alpha'' \cos \beta' = 0.25902 \times 0.99711 = 0.25827$$

$$\alpha_1 = 14^\circ\ 28'\ 53''$$

$$\cos \delta' = \cos \alpha_1 \cos \beta' = 0.96824 \times 0.99711 = 0.96544$$

$$\delta' = 15^\circ\ 6'\ 30''$$

$$a' = \frac{K'}{2\pi \tan \delta'} = \frac{0.71868}{2 \times 3.1416 \times 0.26998} = 0.42366 \text{ in.}$$

Considering next the lesser lead, we have:

$$\tan \beta'' = \frac{K}{2\pi R} = \frac{0.33014}{6.2832 \times 1.5} = 0.03503$$

$$\beta'' = 2^\circ\ 0'\ 23''$$

$$\tan \alpha_2 = \tan \alpha'' \cos \beta'' = 0.25902 \times 0.99939 = 0.25886$$

$$\alpha_2 = 14^\circ\ 30'\ 46''$$

$$\cos \delta'' = \cos \alpha_2 \cos \beta'' = 0.96809 \times 0.99939 = 0.96750$$

$$\delta'' = 14^\circ\ 38'\ 53''$$

$$a'' = \frac{K''}{2\pi \tan \delta''} = \frac{0.33014}{6.2832 \times 0.26136} = 0.20103 \text{ in.}$$

To capitulate, referring to Figs. 54 or 55, we have the following:

	Cutting edges	Greater lead	Lesser lead
Angle of tool	14° 50′ 15″	15° 6′ 30″	14° 38′ 53″
Distance off center measured vertically	0.31503 in.	0.42366 in.	0.20103 in.

In all these examples, as noted before, we will deal only with the tangent to the profiles at the pitch radius. In the case of straight radial flutes, this tangent remains constant regardless of the amount of relief or number of cutting flutes. This tangent was at the angle α'' in the preceding examples.

When the gear hob has helical cutting flutes, usually normal to the helix of the cutting edges at the pitch diameter, the axial section of the relieved surfaces of the hob shows a distortion in form. In addition, with helical cutting flutes, the equations for the greater and lesser leads of the relieved surfaces are different from those for straight flutes. Thus when

R = pitch radius of hob

α'' = angle of tangent in axial section to helicoid of the cutting edges at R

L = lead of cutting flutes

ε = helix angle of cutting flutes at radius R measured from the axis of the hob.

$$\tan \varepsilon = \frac{2\pi R}{L}$$

$$\text{Greater lead} = K + NF \cos \varepsilon \tan \alpha''$$

$$\text{Lesser lead} = K - NF \cos \varepsilon \tan \alpha''$$

The axial section of the relieved surfaces, due to the relief and the helix of the cutting flutes, will be distorted at the tip and on the sides of the hob tooth. Referring to Fig. 56, let

Δ = distortion angle at tip

Δ' = angle on side of greater lead

Δ'' = angle on side of lesser lead.

Then

$$\tan \Delta = \frac{NF}{L}$$

$$\cot \Delta' = \cot \alpha'' - \tan \Delta$$

$$\cot \Delta'' = \cot \alpha'' + \tan \Delta$$

As a definite example we will take a 6-D.P. hob, 14½-deg. pressure angle, 3-in. pitch diameter, double threaded with helical cutting flutes normal to the helix of the cutting edges of the pitch diameter. This hob will have 15 cutting flutes and a radial relief of 0.200 in. per flute. This relief is much greater than would be used in practice, but it is used here to bring out more prominently the nature of the distortion. This gives us the following values:

$R = 1.500$ in.

$\alpha = 14\frac{1}{2}^\circ$

$P = 0.5236$ in.

$M = \frac{1}{6}$

$N = 15$ flutes

$F = 0.200$ in. per flute

$$\sin \beta = \frac{2M}{2R} = 0.1111$$

$$\beta = 6^\circ\ 22'\ 46''$$

$$K = \frac{2P}{\cos \beta} = 1.05372 \text{ in.}$$

$$L = \frac{2\pi R}{\tan \beta} = \frac{3 \times 3.1416}{0.11180} = 84.30034 \text{ in.}$$

$$\tan \alpha'' = \frac{\tan \alpha}{\cos \beta} = \frac{0.25862}{0.99381} = 0.26023$$

$$\alpha'' = 14^\circ\ 35'\ 12''$$

$$\tan \Delta = \frac{NF}{L} = \frac{15 \times 0.2000}{84.30034} = 0.03559$$

$$\Delta = 2^\circ\ 2'\ 18''$$

$$\cot \Delta' = \cot \alpha'' - \tan \Delta = 3.84274 - 0.03559 = 3.80715$$

$$\Delta' = 14^\circ\ 43'\ 2''$$

$$\cot \Delta'' = \cot \alpha' + \tan \Delta = 3.84274 + 0.03559 = 3.87833$$

$$\Delta'' = 14^\circ\ 27'\ 30''$$

The calculation of the angle and setting of the relieving tool is made in the same manner as for straight radial cutting flutes except that the angle Δ' is substituted for α'' in the second equation for the greater lead, and the angle Δ'' is substituted for α'' in the second equation for the lesser lead. This gives us the following:

$$\tan \beta' = \frac{K'}{2\pi R} \quad \text{and} \quad \tan \beta'' = \frac{K''}{2\pi R}$$

$$\tan \alpha_1 = \tan \Delta' \cos \beta' \quad \text{and} \quad \tan \alpha_2 = \tan \Delta'' \cos \beta''$$

$$\cos \delta' = \cos \alpha_1 \cos \beta' \quad \text{and} \quad \cos \delta'' = \cos \alpha_2 \cos \beta''$$

$$a' = \frac{K'}{2\pi \tan \delta'} \quad \text{and} \quad a'' = \frac{K''}{2\pi \tan \delta''}$$

Thus far we have considered radial cutting flutes only. The use of an undercut flute introduces further distortions into the form of the tooth on the hob. Undercut flutes are seldom used on hobs for gears for several reasons. In the first place, an undercut flute makes a weak cutting edge at the tip of the hob tooth which soon breaks down if the hob

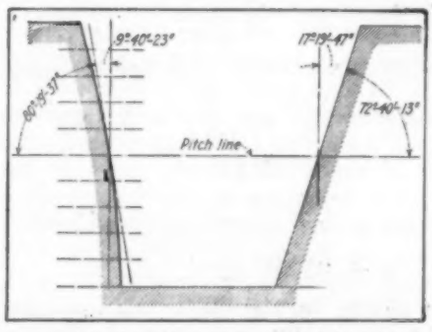


Fig. 58 — Intersection of helicoidal surfaces of a relieved hob with a plane tangent to the base cylinder

is used for roughing because the tip of the hob tooth takes the heaviest cuts. On the other hand, if the hob is used only for finishing the sides of the gear tooth profile, an undercut flute helps produce a smoother cut. A second disadvantage of an undercut flute is the greater difficulty of sharpening it properly, particularly if the flutes are helical. A third disadvantage is the difficulty usually experienced in correcting the form of the relieved surfaces to compensate for the undercut flute. The curve of the intersection of an involute helicoid with a plane parallel to its axis is not symmetrical unless the plane actually passes through the axis of the helicoid. With a straight flute which is undercut, we have the conditions shown in Fig. 57, where

h = distance of flute or intersecting plane from axis of involute helicoid.

The equation of the intersection curve of an involute helicoidal surface with such a plane is as follows:

$$x = \frac{K}{2\pi}\left(\frac{\sqrt{h^2 - a^2 + y^2}}{a} - \arccos\frac{ay \pm h\sqrt{h^2 + a^2 + y^2}}{h^2 + y^2}\right)$$

The equation of the tangent to this curve measured from the x-axis is as follows:

$$\tan \phi = \frac{dy}{dx} = \frac{2\pi a(h^2 + y^2)}{K(ah \pm y\sqrt{h^2 - a^2 + y^2})}$$

When this intersecting plane is tangent to the base cylinder, h becomes equal to a, and the foregoing equations reduce to the following:

$$x = \frac{K}{2\pi}\left(\frac{y}{a} - \arccos\frac{ay \pm ay}{a^2 + y^2}\right)$$

$$\tan \phi = \frac{2\pi a\,(a^2 + y^2)}{K\,(a^2 \pm y^2)}$$

In this case, one side of the profile becomes a straight line while the other is curved. To show this graphically, we will plot the intersection curve of the triple-threaded hob used in a previous example with a plane tangent to its base cylinder. This gives us the following values:

K = 1.59309 in.
a = 0.81256 in.
R = 1.5000 in.

	One Side		Opposite Side	
y	x	x—0.46805	x	x—0.32153
1.3333	0.41605	—0.05200	0.29532	—0.02621
1.3667	0.42645	—0.04160	0.30019	—0.02134
1.4000	0.43685	—0.03120	0.30525	—0.01628
1.4333	0.44725	—0.02080	0.31050	—0.01103
1.4667	0.45765	—0.01040	0.31594	—0.00559
1.5000	0.46805	0	0.32153	0
1.5333	0.47845	+0.01040	0.32730	+0.00577
1.5667	0.48885	+0.02080	0.33321	+0.01168
1.6000	0.49925	+0.03120	0.33927	+0.01774
1.6333	0.50965	+0.04160	0.34548	+0.02395
1.6667	0.52005	+0.05200	0.35182	+0.03029

The tangent to these curves at the pitch line become:

$$\tan \phi \text{ (one side)} = \frac{2\pi a}{K} = \frac{1}{\tan \delta} = 3.20476$$

$$\phi = 72^\circ\ 40'\ 13''$$

$$\tan \phi \text{ (opposite side)} = \frac{2\pi a(a^2 + R^2)}{K(R^2 - a^2)} = 5.26677$$

$$\phi = 80^\circ\ 19'\ 37''$$

These values are plotted in Fig. 58. The opposite side is plotted in the reverse direction along the x-axis so as to show the form of the tooth space of the hob.

The calculation for the angle and setting of a relieving tool for this type of cutting flute are too long and complex to be included here. When the helix angle of the hob is small, however, and the axial section of the involute helicoid of the cutting edges is a close approximation to a straight line a simple solution is available, since a straight-sided tool set at the center of the hob can produce a satisfactory radial-flute hob. To produce such a hob with undercut flutes, a close approximation to the correct form of the relieved surfaces can be obtained by setting a suitable distance off center the same tool that would be used to produce the radial-flute hob. This distance would be determined for straight undercut flutes as follows:

When R = pitch radius of hob
N = number of flutes
F = radial relief of hob per flute
h = distance of undercut flute off center
j = angle of radial relief
j' = angle of undercut flute with centerline of hob
j'' = angle to tip tool to compensate for undercut flutes
h' = distance off center to set relieving tool.

$$\tan j = \frac{NF}{2\pi R}$$

$$\sin j' = \frac{h}{R}$$

$$\cos (j + j'') = \cos j\,(1 - \tan j \tan j')$$

$$h' = R \sin j''$$

The setting of such a tool to produce a similar hob with helical undercut flutes would be the same as the foregoing except that

$$\tan j = \frac{NF \cos \varepsilon}{2\pi R}$$

Where ε = helix angle of flute at radius R measured from the axis of the hob
L = lead of flute

$$\tan \varepsilon = \frac{2\pi R}{L}$$

As a definite example we will take a hob, 3 in. in pitch diameter, having 15 straight flutes with 0.100 in. radial relief per flute, and 0.300 in. undercut. The radial relief here is greater than would be used in actual practice, but it is used in this example to bring out more clearly the change in the setting of the tool required to compensate for it. This gives the following values:

R = 1.5000 in.
N = 15 flutes
F = 0.1000 in. per flute
h = 0.3000 in.

$$\tan j = \frac{15 \times 0.1000}{2 \times 3.1416 \times 1.500} = 0.15915$$

$$j = 9^\circ\ 2'\ 34''$$

$$\cos j = 0.98757$$

$$\sin j' = \frac{0.300}{1.5000} = 0.2000$$

$$j' = 11^\circ\ 32'\ 13''$$

$$\tan j' = 0.20412$$

$$\cos (j + j'') = 0.98757\ (1 - 0.15915 \times 0.20412)$$
$$= 0.95549$$
$$(j + j'') = 17° 9' 30''$$
$$j'' = 8° 6' 56''$$
$$\sin j'' = 0.14117$$
$$h' = 1.500 \times 0.14117 = 0.2118 \text{ in.}$$

In this example, the same tool that would be set on center to produce a radial flute hob would be set 0.2118 in. off center in the direction of the undercut to produce the undercut-flute hob.

It should be apparent that great care should be exercised in resharpening a hob. If the flutes as ground are not accurately indexed, or if the flute surface is not maintained in its proper relationship to the axis of the hob, the cutting edges will not remain in the surface of the helicoid to which they belong. The original accuracy of the hob may thus be lost entirely by carelessness in resharpening.

Wages Are Not All—Discussion

By J. H. Wickman

I WAS much amused reading the article by William Stepanoff on page 154, Vol. 67, of the *American Machinist*, because I had just finished reading an article by the chairman of the Finance Committee of the E. I. du Pont de Nemours Co., on "How to Maintain a Competent and Loyal Executive Staff," and another article by W. T. Magruder, Professor of Mechanical Engineering, Ohio State University, on "Why Not Direct Young Men to an Engineering College?"

Mr. Stepanoff shows dissatisfaction with his income as a machinist as compared with the bricklayer or other organized tradesman, which is quite a common complaint nowadays. It is not, however, the wide variation of wages that creates this dissatisfaction as much as it is the wants and desires that are constantly being thrown in front of them every day by advertising and easy-buying plans. The automobile, radio, good furniture, iceless refrigeration and a dozen other things are within the reach of every one with most any kind of a job if he is willing to take them on the installment plan, which means the mechanic is usually left without much money. There would probably be less dissatisfaction amongst machinists if they would balance their living expenses against their incomes and live on a strictly cash basis.

Professor Magruder's article states there are five requests for the services for every mechanical or engineering man that graduates from the schools in the United States. This looks as if there was a shortage of good men, but it seems, as an argument right now, if this shortage did exist there would be better offers for the services of these young men, that is, more than 55 or 60 cents per hour, or about $125 per month, which would also eventually improve the condition spoken of by Mr. Stepanoff.

Mr. du Pont's article has the true ring to it as far as keeping satisfaction amongst employees, and that is, if necessary, have the name of paying too much rather than too little, which agrees fairly well with the tone of Mr. Stepanoff, who does not want any "glory," as it will not support the family. Stop and think of these three writers, widely separated, mentally, financially, theoretically, and otherwise. One says he wants more, one that it is there for the taking, and the other, "I want to give it to you freely."

Magnetic Gleaners Save Equipment

By Elton Sterrett

"OVERLOADING," said the tire manufacturer, when the Perfection Pump Co. complained of the short life of rubber tires on its fleet of shop tractors, "trying to haul five tons on equipment designed for two."

Admittedly the service was hard. The storage-battery tractors not only carried capacity loads on their own platforms, but often pulled from three to five heavily-laden trailers—all increasing the demand on the tractor tires. But at first glance, conditions were all that could he desired. The factory floors were of end-grain wood block, and the runways between the various buildings were composed of heavy timbers, laid diagonally to avoid the uneven surging strains that result from running over transverse or longitudinal joints.

It was not until a representative of the rubber company made a stop-over at the pump plant, that the two principal causes contributing to the rapid wear were discovered. Sections of the floor adjoining many of the machines were constantly wet with cutting compound—just where the tractors met the most severe starting load—and the presence of the compound (as with water or any liquid) rendered the rubber most susceptible to cuts and abrasion. And at these same critical points in the tractors' travel there was abrasive in quantity—chips from the machines in long razor-edged spirals and short jagged pieces, all embedded in the wood flooring.

The pump company's superintendent immediately took steps to remove both contributing causes. Guards and deflectors on lathes, drill presses and the like, were redesigned to intercept practically all the cutting compound—without sacrificing either visibility or convenience of adjustment of the work—and the floors were worked over by a scraper crew who managed to clear away most of the imbedded chips, driving those too firmly fixed to be loosened deeply into the block. Then, as a final step, the tractors were each equipped with a pair of low-hung bar electromagnets, so installed that they could be readily swung aside for clearing them of accumulated chips. Largely as a matter of interest, a check was kept on the weights of metal collected by these magnets, and the surprisingly high average of 284 pounds per week was recorded.

The magnets were so attached as to be readily removed if the tractor was to be used over a surface too rough for their limited clearance, while a switch on the operating handle provided a handy cut-off for the magnet current if the operator was not scheduled to use the tractor through a department where chips would be encountered.

Close check of the power used in charging the tractor batteries before and after installing the "iron brooms," as the men termed them, showed a daily average current cost of seven cents per tractor for magnet power—a figure much below the saving in tires, not attempting to evaluate the gain through the transportation equipment being always ready for use. Also, the continued removal of chips from the aisles assisted in promoting cleanliness.

When the driveway to the garage that the company erected for the employees' cars, was paved with cinders, the tractors were run over the roadbed at intervals, and a total of eighty-four pounds of scrap iron, nails and spikes was collected by the first electric "gleaning."

THE · FOREMAN'S · ROUND · TABLE

Tool Sales in the Shop

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"DON'T see as they got anywhere with the discussion tonight, Al," said Ed, as they rattled home from the Foreman's Club meeting in the box of bolts that had served three years as a car.

"You know how our plant feels about private tools, especially "mikes" and measuring instruments. Willing to furnish them to the men. But the mechanics, most of them, want their own set of tools. Look at old Magregor. Got a beautiful set of machinist's tools, and keeps them in wonderful shape, like family jewels. Men like him wouldn't think of depending on tools that the whole shop uses. His toolbox to him is a symbol of his trade."

"That's right, Ed, but I think that the majority at the meeting agreed on that point. The big unsettled question seems to be whether the shop should buy the tools and sell them to the men at wholesale prices.

"If the purchasing department buys a stock of small tools to sell to the men, it can get them at wholesale prices and make favorable rates to the men. But is it worth while, Ed? The case brought up by Jones of the Steel Works won't fit all shops. They have a big staff of trained mechanics over there, and they can keep a good stock of tools on hand. But the little shop with a dozen mechanics can't keep a hardware store on hand to accommodate a workman once in a great while. Tools don't wear out fast, you know, Ed, and after a mechanic is once fitted out he doesn't buy a tool very often. Then he doesn't know far in advance what he needs."

"All right, Al, then how about Perkin's idea of having the company buy the tool for the man at the time."

"That's bad, too, in some ways, Ed. Seems to me that buying a dollar scale for a man would cost the company more in paper work, overhead, and time of the purchasing department than the scale was worth.

"I can't see any fixed rule to govern the thing, Ed. If the shop is big enough, let it go into the tool selling idea, but for the average shop that couldn't afford to keep a stock it might be an expensive proposition."

Should the company sell tools to the mechanics?
Is the shop justified in encouraging private sets of tools?
Does it pay to forward purchase orders for the men?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Keeping Down the Work in Process

OUR experience shows that the amount of work in process is a direct function of the finished work in stock. When we increase or decrease the finished inventory of any assembly we automatically pay the same attention to the work-in-process of all its detail parts. Hence we find that in the long run a close watch on finished stock resolves itself into a close enough control of work in process. The most economical point at which to hold the finished stock inventory varies, but we believe the average to be from two to three months' requirements. Some years ago we carried higher inventories than that, and then three or four years ago we went to the other extreme and carried only two or three weeks' supply. Both policies were costly, the former because of the financial burden of the high carrying charge, and the latter because of unsatisfactory deliveries and the increased cost of special handling of small lots. Decision as to what quantities to bring through cannot follow any set rule. It is always a complicated problem, and must be based on past experience, shop and general business conditions, expected demand, the possibility of obsolescence, operation and set-up times, and most of all good judgment. A zero inventory would be good policy in the case of special devices which are not standard and may never be called for again, or in cases where a change in design is imminent. An abnormally high inventory would be justified in instances where expensive set-ups are required.

—Wm. C. Landis.

Abolishing Private "Mikes"

THE foreman was certainly responsible for Bill's spoiled work, and it shows very poor ability on his part to allow any operator whether a new or old one to turn out a number of pieces without having had the first one inspected. Had this been done the error would have been discovered on the first piece and the spoiled work avoided.

I do not believe it would be wise to put through an order abolishing private "mikes," as I believe all workmen who have occasion to use micrometers should at least possess a 0 to 1 in. of their own, except in the case of the inspector who uses "mikes" almost constantly, and as these are subject to a great deal of wear, the company should provide them. The company should furnish all "mikes" above 1 in., and should establish the check system of loaning "mikes" to workmen, each instrument to have a serial number, and all to be returned at the end of each week for checking. It may necessitate a little overtime to check the "mikes," but it is worth it.

Al was right as to foremen failing to inform men of shop facilities. A set of rules should be established, and the workmen advised. I would recommend that these rules be printed in card form, and new employees be given a copy at the time of engagement.

—Stanley W. Sullivan, *Foreman.*

SUCCESSFUL use of individual tools in any shop where a high degree of accuracy is required must necessarily depend upon the care with which the owner of each tool checks the accuracy of that tool against some standard. The true mechanic has a high respect for his tools which amounts almost to affection, and he will always dispute the accuracy of his instruments. The purchase of a sufficient number of micrometers to equip an entire shop would be expensive, and it would be difficult to prevent the machinists from reverting to the use of their own tools if they could possibly find any excuse to lay aside the "mike" furnished by the shop. Would it not be just as advisable and just as satisfactory all around to insist upon a rigid checking of all personal "mikes" used in the shop, and then to hold each operator absolutely responsible for the accuracy of the work turned out? A few extra micrometers could be kept in the toolroom and supplied to the machinists where the accuracy of the personally owned "mike" was in question, or where such an instrument had to be returned to the factory to be brought up to standard. The micrometer is considered by many machinists as a part of their personal equipment. They are proud of the possession and the ability to use an instrument having such a degree of accuracy, and there might be an advantage to the shop in encouraging this method rather than installing a system which would smack so much of paternalism, as does complete control of tools.

—R. B. Smith, *School Principal.*

THE company should supply all measuring instruments, as they are such an essential part of a production program that any expense that will tend to assure their accuracy should be cheerfully assumed by the company. Human nature being as it is, there will always be those who insist on using old ones after their usefulness is long past, borrowing their neighbors, or buying them "second hand" just to have them, without a sufficient regard for their real usefulness.

Micrometers should be handled on tool checks, like any other company tool. They should be recalled periodically for check, but after check they should be re-

THE · NEXT · TOPIC

The New Man in the Shop

QUESTION

What is the best way of starting a new man in the shop?

Should we give him a job and let him work out his own solution?

turned to the same mechanics. By this procedure, the illogical but constantly recurring excuse that "the mikes were different," is overcome. —Wm. T. Van Horn.

WHERE close accuracy is required the shop should furnish all necessary measuring instruments. A well managed toolroom is certainly better fitted to keep these tools in first class condition than an individual. These instruments should be checked out by the toolroom to the workmen and at the completion of the job should be thoroughly checked before they are issued again. The shop in most cases furnishes all inspection gages and assumes the responsibility for their accuracy. Therefore is it not logical to expect better work when the tools of the workmen are kept up to the same standards as the tools of the inspector? —John J. Clay.

Using Makeshift Tools

MAKESHIFT tools are life savers when parts are wanted in a hurry or when the total number of articles to be made is small; but they should have no place in any program which calls for the continued production of a piece month after month in sizable quantities. While opposed to the use of this type of tool, I must admit that on several occasions my skin has been saved by their use when I had not made the necessary provisions for new parts that had to be manufactured.

Whether it is better to pay more for the product by struggling along with unsuitable equipment, or to spend money on new methods is a matter of analysis contingent upon the number of pieces which will eventually be manufactured. If the saving which will be effected by the new line-up is more than it will cost to install it, then it is common sense to invest the amount required for the proper tools. —H. C. Kline.

IF WILLIAMS went into Ed's idea in the light of his actual experience, and the actual current order for parts, he was undoubtedly correct in his decision to pass up his makeshift idea and buy a new machine. There is, of course, the danger that Williams' enthusiasm for future business may cause him to figure that the potential business would require and justify a new machine and that conditions entirely beyond his control may cause that business to fall through, and thus make a poor decision out of what otherwise would have been an excellent one. So, just as long as there is no attempt to capitalize a present situation as a basis for justifying new equipment in the hope of future orders, I'd heartily favor buying new equipment instead of using makeshift tools. —George W. Stedman.

IN SMALL quantity production makeshift tools, when reasonably accurate and strong, fulfill the demand perfectly. In real heavy production work, where the quantity being produced is continuous and never reduced greatly, the interval of time during the performance of functions becomes of great importance. The use of makeshift tools in such production is costly in more than one respect.

The continual use of makeshift tools reduces the accuracy of the tool which results in a greater waste of material and increases the scrap. It increases the time necessary to produce the work, which results in the necessity to increase the workman's rates in order that he may make fair wages. The maintenance and upkeep of such tools are great, and often cause delays in the line of production. —J. Waitkus.

Should the Foreman Get a Bonus?

I KNOW several engineering firms that give a percentage upon production to their foremen. When a man is appointed assistant foreman, and has proved himself suitable for the post, he is put on the bonus list, which has a most stimulating effect especially with the young men. They feel they have received some recognition from the Director, both verbally and financially. The bonus is based upon the output for the month, and each foreman receives varying percentages according to length of service and importance.

It then becomes to the interest of every foreman to try by co-operation with other foremen and with his own department to get as much out as possible each month. In fact, it effects a clearing up of the shop every month to make each month better than the last, and also to try and get on the higher rate of bonus.

A straight salary has not the same lasting effect. A man with a big salary will make a big stir when first appointed, but let him get in a tight corner when there is no one to help him out, and it is then that the big salary fails to have the same effect as the bonus.

—H. Maplethorpe, *England.*

SINCE foremen are human a bonus for foremen will increase production. In immediate contact with men and methods, the foreman is ideally situated to obtain that "little bit more" which can always be secured whatever may be the general level of production. To get this "little bit more," the foreman must give closer attention to the details of organization and functioning of his department. He must see to it that tools and jigs are properly suited to their work, and are kept in good order; that blueprints, gages, etc., are forthcoming on request; that material is at hand exactly when, where, and how it is required; that transport requirements are intelligently anticipated, and finished components promptly removed; above all, he must assiduously cultivate good workshop conditions—cleanliness, adequate lighting, ventilation—for these promote mental and physical alertness, and lead to increased production.

—F. C. Edwards, *England.*

Should the Shop Govern Purchases?

DESIGNATING the class of material should certainly be the work of the designers. They know what function any given part has to perform, and in making their calculations base them on the use of specified grade of material. The one exception I would make is with regard to the shop that could safely be left to order small tools such as drills, taps, and reamers.

With reference to money saved always staying saved, one has only to think of forgings or castings bought outside. A purchasing agent can readily be deceived into accepting a relatively low price per ton, but unless he is acute enough to tie the contractor down to a definite weight, a price that appears low in the first case will be more than offset by an excessive weight.

—T. H. Hargrave, *England.*

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upward, depending upon their merit.

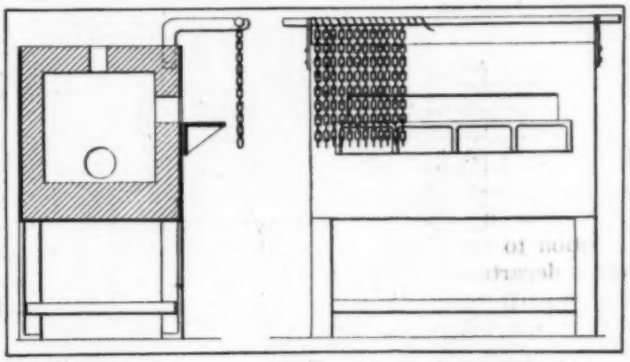
Protecting Workmen from Furnace Radiation

By A. Koeniger

Montigny-les-Metz, France

In many cases the radiation from oil or gas furnaces constitutes a bad condition for the workmen of the shop. This condition may be remedied very effectively by the application of a shield formed by lengths of chain suspended from a steel wire or by rings from a pipe or bar in front of the furnace.

I have applied the screen shown in the illustration, which can be made easily in any shop. The steel chain



Guard to protect workmen from heat radiation

is a standard small commercial chain. The rod or pipe simply rests on two supports at each side of the furnace. It can be removed or replaced instantly, and the flexibility of the chain permits attention to the furnace without hindrance. The screen is very effective against radiation of the heat into the room.

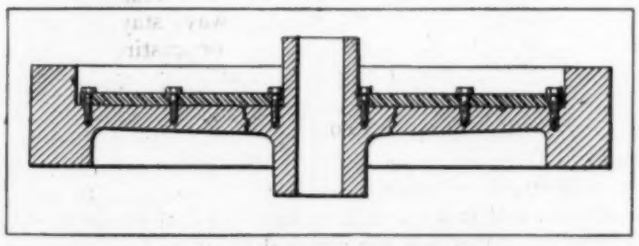
Repairing Flywheels

By A. F. Graves

In our shop we have had considerable trouble from cracked spokes in the flywheels of our punch presses. While the repairs might have been made by welding, it was decided that the work be done in the following way:

A wheel was mounted in a boring mill and the hub and rim on one side were recessed, as shown in the sketch. The spokes also were faced flush with the bottom of the recess.

A 1-in. steel plate was faced on one side and bored 0.020 in. smaller than the hub for a shrink fit. The outer diameter of the plate was turned to a size that would allow it to go in the recess when heated. After shrinking the plate on the hub, it was fastened to the wheel by capscrews in the rim and spokes as shown. The shrink fit on the hub, plus the holding power of the capscrews, made a very strong job.



How the flywheels were repaired

Method of Mounting Dies

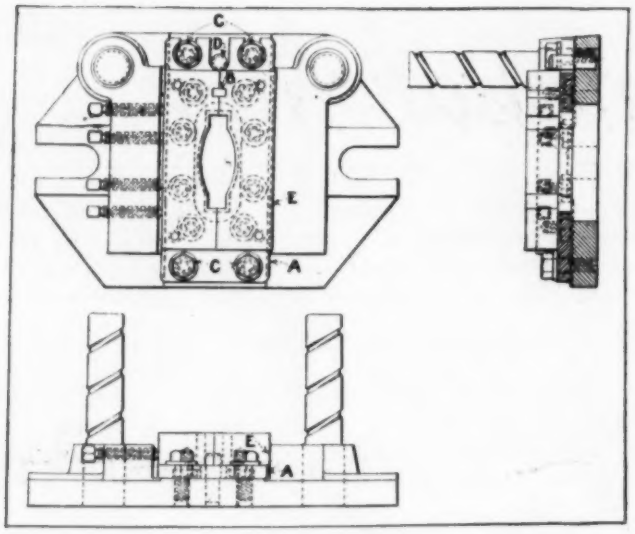
By Henry Simon

The method of mounting dies, as shown in the illustration, was devised for certain blanking dies that were required to produce well-finished blanks from metal of exceptional hardness. Because of the hardness of the metal, frequent light grinding was necessary. Since the blanks must be held to close limits as to width, the dies were made in two parts.

The two halves of the dies were mounted on quick-removable base plates, or slides, fastioned to the die shoes. No change in the design of dies or shoes was necessary, though the depressions in the shoes for the dies had to be somewhat deeper, therefore a shoe slightly heavier than would ordinarily be used, was found advisable.

The slide *A* is a plate of machine steel to which the two die halves, keyed together at *B*, are held by screws from the under side. The slide is about the same width as the die, but is enough longer at each end to make room for the heads of the four clamp screws *C*. The two front screws pass through holes in the slide, while slots are provided for the two rear screws. A third slot between these two makes room for the end-locating pin *D*, which is firmly driven into the die shoe. It should be noted that the slot for the relocating pin extends slightly beyond the rear edge of the die and that the right-hand edge of the slide is held slightly back from the registering face *E* of the depression in the shoe. The presence of the slide has therefore no effect whatever upon the locating of the die, which registers directly against the pin *D* and the surface *E*.

By means of this construction, removal and relocation of the die are rapid and dependably accurate. By merely loosening the side screws and the rear clamp screws a single turn, and removing the front clamp screws, the slide with the die attached can be withdrawn, ground, and slipped back again with the assurance that it will



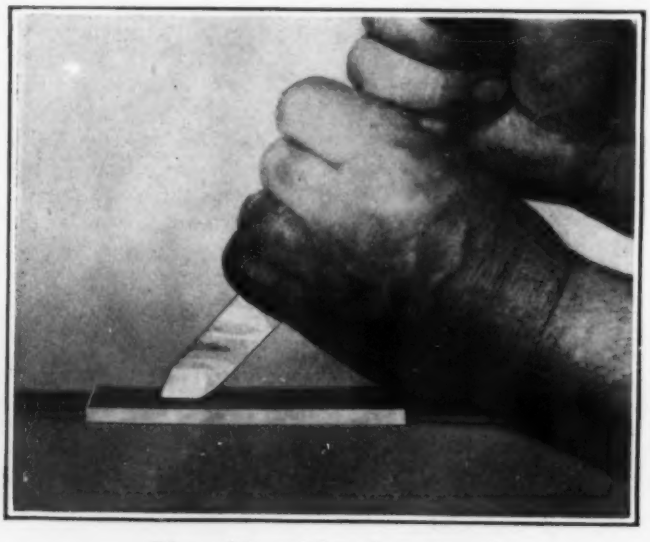
How the die was mounted

be accurately replaced in its location, while it will be held down as rigidly as if it were screwed to the shoe itself. A particular advantage in connection with a split die, is that the two halves always remain together during removal and grinding, and need to be taken apart only when it becomes necessary to grind the meeting faces in order to true up the width of the opening. The same method of mounting could be used to advantage in some cases on one-piece dies, just as it would be equally advantageous to use it on plain shoes, as well as with the pillar type shown in the illustration.

Cutting a Belt to Narrower Width

By Arthur Kendall

When I required a narrow belt for experimental purposes and found there was none in stock, I took an old belt and sliced it in two, lengthwise. I remembered an occasion some years previously when I had the same job to do and did it free hand, as it were, and the sliced part did not come out to my satisfaction. This time I thought a little guide would be beneficial so I made the one illustrated out of sheet metal, bending it over at each side to fit the belt nicely and slotting it for the knife with one blow of a chisel. Securing the belt on the end of the bench I put the guide in place, dug the knife into the belt through the slot and ran it along the entire length in quick time, the guide travelling along with the knife. I did not succeed in cutting quite through the belt, but all I had to do was to cut through at one end and draw the knife along the previously cut straight line.



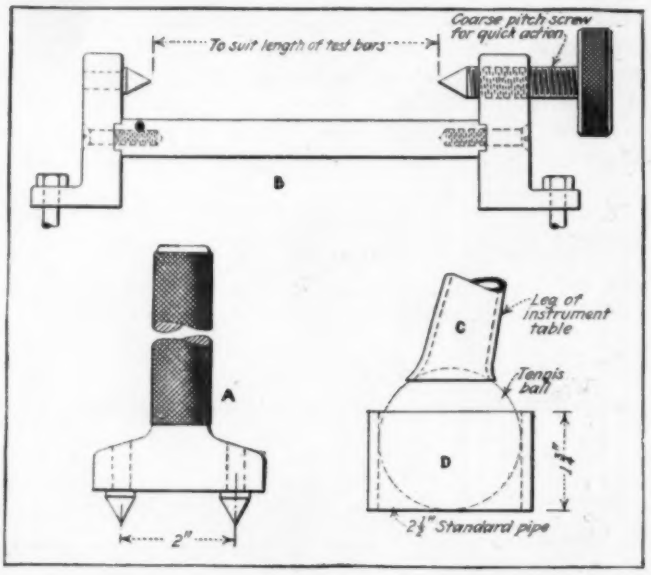
The guide and how it was used

Aids to Laboratory Work

By Walter C. Tappan

The twin punch *A* will be found useful for marking test pieces before testing, so that the elongation in a length of 2 in. can be measured. After the test piece has been ruptured, the pieces can be held together in the centers *B* and the distance between the marks made by the punch *A* will show the amount of elongation when compared with their original distance.

In making micro-photographs, it is a hard matter to prevent the camera from vibrating, especially in a building where drop hammers are in use. If the legs of the table supporting the camera are made as at *C* and tennis balls set in short pieces of pipe are placed between the legs and the floor, as at *D*, a great deal of vibration will be absorbed.



Useful devices for the laboratory

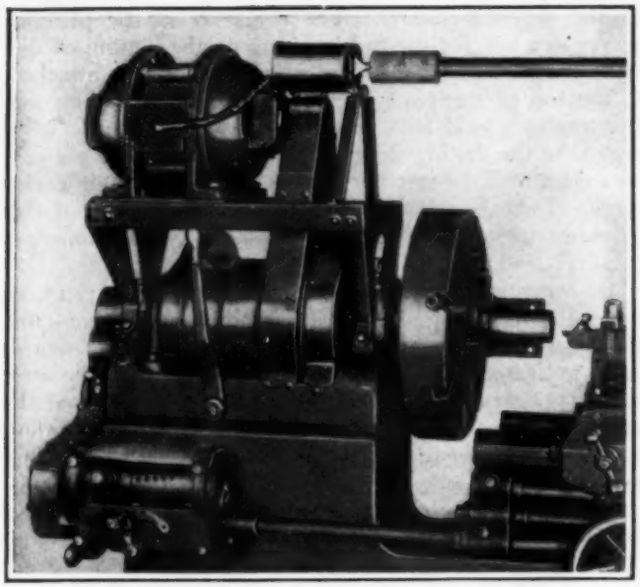
Application of a Motor to a Belt-Driven Lathe

By W. S. Vincent

The accompanying photograph shows a 19-in. heavy-duty, LeBlond gap-lathe, that we changed from cone-drive to direct-motor drive.

There are two distinct features of this arrangement other than making it a self-contained unit, which we find makes this an ideal piece of equipment, namely: accessibility of control and increased speed range. The controller is so arranged that the shaft is extended in the same plane as the shifter rod, and is turned by the hand in place of being shifted. The index on the drum or cylinder, close to the controller, is provided with speed markings and is a convenient means for the operator to set the controller for the speed desired.

The lathe originally had nine speeds through the 3-step



Motor applied to a belt-driven lathe.

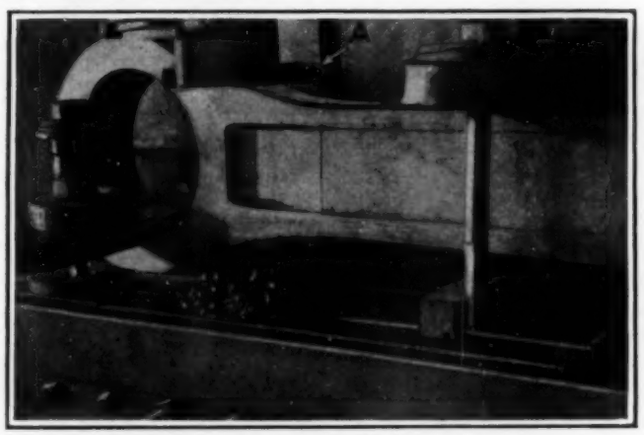
cone and the two-speed back gears. By connecting the four-speed motor to the large step of the cone by means of a link-belt silent chain, three additional speed ranges were gained. The speed-range of the machine as it now stands is from 10.6 r.p.m. on the slow gear to 310 r.p.m. on the fast direct drive.

The change was made at an expense of approximately $300 and increased the efficiency of the lathe approximately 25 per cent, as well as making the lathe transferable from one location to another.

Cutting Clearances Preparatory to Planing Channels in Side Rods

By George H. Feltner

Not having a milling machine with which to channel side rods, necessitated doing the work in a planer. The necessary clearances for the planer tool were cut in a vertical spindle machine, using a fly cutter, as shown at *A* in the illustration.



Cutting clearances in side rods

With a rod mounted on the table of the machine, and adjusted so that the cutter would cut into the side of the rod, the cutter was fed downward until the clearance was of the same width as that of the channel to be planed.

Method of Finding Blank Diameters for Cylindrical Drawn Shells

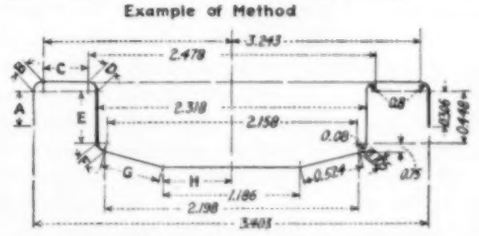
By Ronald T. Wakelee

The method of finding blank diameters for cylindrical drawn shells is based upon the assumption that the area of the blank is equal to the combined areas of the elementary areas composing the shell: in other words, that the section remains uniform at all points

Factors of Segments of Drawn Shells

Segment of Shell	Factor	Segment of Shell	Factor
Fig.1	$\frac{d^2}{4}$	Fig.9	$2\pi(0.7854\,d-r)$
Fig.2	$\frac{(d+d_1)(d-d_1)}{4}$	Fig.10	πrd
Fig.3	dh	Fig.11	$dl-2rh$ wherein, $J=0.01745\,n$ n = No. of Degrees
Fig.4	$\frac{s(d+d_1)}{2}$ wherein $s=\sqrt{h^2+\frac{(d-d_1)^2}{2}}$	Fig.12	$dl+2rh$ wherein, $J=0.01745\,n$ n = No. of Degrees
Fig.5	$2\pi r^2$	Fig.13	πrd
Fig.6	$2\pi rh$ or, $\frac{d^2}{4}+h^2$	Fig.14	$2\pi rh$
Fig.7	$2\pi rh$	Fig.15	πrd
Fig.8	$2\pi r(r+0.7854\,d)$	Fig.16	$\frac{d^2}{4}+h^2$ wherein, $h=r-\sqrt{(r-\frac{d_1}{2})(r+\frac{d_1}{2})}$

Example of Method



Line drawn midway between inner and outer walls of shell

General Rule: Blank diameter equals twice the square root of the sum of factors

Factor of segment A (Fig.3) = 3.403×0.306 = 1.041
B (Fig.8) = $2\pi.08(.08(.7854+3.243)$ = .0420
C (Fig.2) = $\frac{(3.243+2.481)(3.243-2.481)}{4}$ = 1.084
D (Fig.9) = $2\pi.08(.7854\times2.478-0.08)$ = 0.299
E (Fig.3) = $2.318\times.448$ = 1.038
F (Fig.12) = $2.158\times.0305+2\pi.08\times.0075$ = 0.239
G (Fig.4) = $.0524\left(\frac{2.198+1.186}{2}\right)$ = 0.887
H (Fig.1) = $\left(\frac{1.186}{2}\right)^2$ = 0.351
5.399 = Sum of Factors

$2\sqrt{5.399} = 4.63$ = Trial blank diameter

Typical sections of shell blanks

instead of becoming thinner at some places and thicker at others as generally is the case to a certain extent. The calculation of these elementary areas is often complex and, in order to simplify this part of the work, some typical sections of which nearly every round shell is composed, such as disks, hollow cylinders, sections of sphere, cones and the like, have been calculated on the

accompanying chart. Since the multiplier π would appear in every equation of area, further simplification has been introduced by using factors instead of the complete area, where factor, $f = \frac{\text{area}}{\pi}$

$$\text{Blank diameter, } D = \sqrt{\frac{A}{\frac{\pi}{4}}}$$

where A = combined areas of elementary segments.

Substituting πF for A, where F equals sum of all factors we have: $D = \sqrt{\frac{\pi F}{\frac{\pi}{4}}} = \sqrt{4F} = 2\sqrt{F}$

In other words, the diameter is equal to twice the square root of the sum of the factors calculated according to the chart.

The procedure in any particular case is as follows:

1—Make a free-hand sketch of the shell section along the centerline of the material (a line drawn midway between the inner and outer walls of the shell.

2—Divide the cross-section of the shell into segments *A, B, C, D,* etc., as shown in the example given below the chart, and place the necessary dimensions thereon.

3—Calculate the factors for each section and tabulate them.

4—Add the factors, extract the square root of the sum, and multiply the result by 2 to find the required diameter.

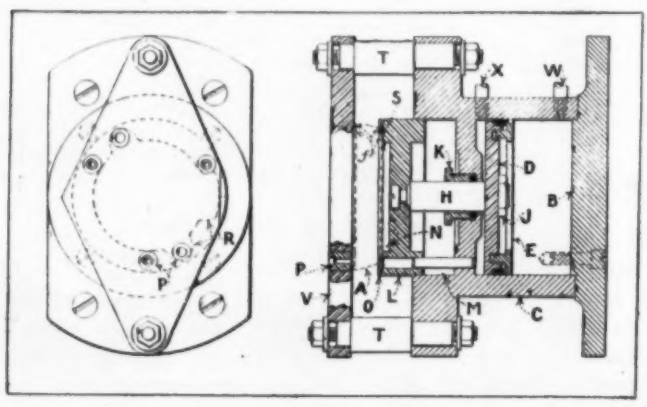
An Air-Operated Drill Jig

By B. J. Stern

A drill jig that is operated by compressed air is illustrated in the accompanying sketch. The operation to be performed consists of drilling five holes in the brass casting shown in dotted lines at *A*. The casting has been previously machined to the finish marks indicated in the figure.

The jig consists primarily of a base plate *B* to which is screwed the cylinder casting *C*, fitting over a shoulder on the base plate. The cylinder contains a piston consisting of the plates D and E that are screwed together, while between them is leather packing that can be compressed by turning the plate *E*. The piston rod *H* is attached to the piston by the nut *J* and passes through the top of the cylinder and through the gland *K*.

The other end of the piston rod is attached to plate *L*, which is a sliding fit in the recess *M* in the upper part of the cylinder casting. The recess *N* in the plate *L* serves as a nut for the finished ring on the bottom of the work-piece. A hardened and ground plate *O* is attached to the top of the plate *L*, the work-piece bottoming on this plate, which also serves to locate the work with regard to the drill bushings *P*. The ring *M* is cut away as shown at *R* to suit the bottom flange *S* on the work-piece. Two shoulder studs *T* attached to the top of the cylinder casting, support the top plate *V* which contains the drill bushings *P*.



Constructional details of the jig

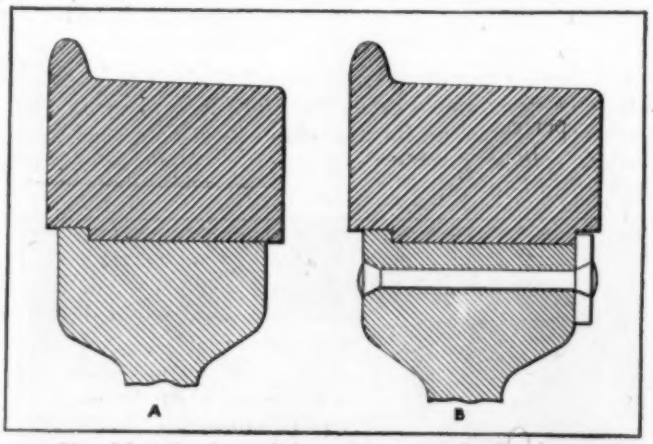
In operation, the piston being in its down position gives the maximum space between the ring *O* and the top plate *V*. The operator slips in this space a work-piece until it drops into its seat in plate *L*. A three-way valve (not shown) is now turned to admit compressed air at port *W* thus forcing up the piston and thereby clamping the work against the top plate *V*. The drilling operation is now performed, after which the valve is operated to exhause the air through port *W* and admit air into port *X*, thereby withdrawing the piston and allowing the work to drop back so that it can easily be removed.

Clamps Help in Shrinking Locomotive Tires in Place—Discussion

By C. G. Williams

The clamps described by Louis L. Locke, in an article under the title given above, and published on page 744, Vol. 66, of the *American Machinist,* are somewhat out of date. Such clamps were used as early as 1900, for I had some of them made while I was a roundhouse foreman, at that time.

About 1904, such clamps were rendered unnecessary, because the practice at that time was to turn a shoulder on the wheel centers for the tires to butt against as shown at *A*. About two years later one large railroad began to use retaining rings on the wheel centers as at *B*. At first the rings were bolted on, but later they were attached by rivets.



Shoulders and retaining rings on wheel centers

Today, none but the smallest and oldest locomotives used on branch lines or for switching would need such clamps as Mr. Locke described.

To avoid crystallization shrinkage in die-castings use as low a metal temperature as possible. It is considered better to increase the heat of the die rather than of the metal.

Industrial Group Insurance

Group insurance for industrial establishments was first written in 1911, and has since increased rapidly. At the end of the year 1926 more than 75 companies were writing this form of insurance, and it is estimated that the insurance in force amounted to $5,600,000,000. According to the definition adopted by the National Convention of Insurance Commissioners, group insurance is that form of life insurance covering not less than 50 employees, with or without medical examination, written under a policy issued to the employer, the premium on which is to be paid by the employer, or by the employer and employees jointly, for insurance which will preclude individual selection for the benefit of persons other than the employer.

The reasons for group insurance is the desire to show appreciation for faithful service, to contribute to the stability of the working force, and to prevent distress amongst families of workmen who through carelessness or inability to pass the physical examination leave no protection to their families. Since life insurance has little appeal for young persons, it is believed that an extension of the plan to include disability and endowment features will make it more attractive to them as an inducement to remain with the firm.

The earlier group insurance policies provided for payment of a lump sum in case of death, the amount ranging from $200 to $1,000, and increasing with each year of service. As the workers came to realize the value of group insurance they desired to obtain larger benefits. It was also found that insurance partly paid by the employee was more appreciated. The present tendency is toward the contributory plan. One insurance company that wrote more than a billion dollars worth of group insurance during 1925 found that 95 per cent was on the contributory basis.

In the usual group-insurance policy no medical examination is required, but in a few states such examination is required by law. The method of issuance is to give the employer a master policy covering the lives of all employees. One of the features of most policies which appeals strongly to the workers is the disability clause, which provides that the worker if permanently disabled shall receive the amount of his insurance either in a lump sum or in installments. In almost all plants an employee upon leaving the company has the privilege of converting his insurance to an individual policy without medical examination at the rate for the class of risk to which he then belongs.

Some industrial plants give policies to their employees at the date of their employment, but it is more usual to require a service period of 1, 2, 3, 4, 6, or 12 months before giving the insurance. The amount of insurance varies greatly. In a few plants the plan provides for a flat sum, but in the majority of the plans the initial amount of insurance is $500 or $1,000, increasing with the years of service until a maximum is reached. Some companies have a plan under which a year's salary is given, while others arrange for the workman's pay to continue for a given number of weeks. An automobile plant with 8,000 employees insures its workers for $1,250, which is increased to $1,500 in six months, $1,600 in a year, and then $100 additional each year until $3,500 is reached. One machine shop, with 450 workmen, gives an insurance policy for $800 after 6 months' service, $1,000 after a year, and then $200 additional each year with a maximum of $2,400. In the case of executives the maximum is as high as $10,000 with some companies.

In many establishments the employer arranges for combination group life, sickness, and accident insurance, part of the premium to be paid for by the worker. In some cases the employer pays for the life insurance and the employee pays for the sickness and accident insurance. Accident policies of this kind are in addition to those for industrial accidents, which are usually covered by compensation laws. The plans for sickness and accident insurance in a number of plants provide for payments ranging from $10 to $15 a week for periods of 13, 26, or occasionally 52 weeks. In some cases the employees are divided into classes according to salary, and receive weekly benefits ranging from $8 to $25, according to the class to which they belong. Where this insurance is given free, the weekly benefit is also based on length of service. In many cases where health insurance is in force, the insurance companies send out health literature, have physicians give health talks, and sometimes include nursing service. This work has the effect of reducing lost time, and is considered by some employers to justify the cost of the premium. In one plant where half of the premium is paid by the company the cost of the life and health insurance to the worker ranges from 13 to 24c. a week. In another company that gives a maximum of $2,500 life insurance, and from $7.50 to $25 weekly sick benefit, the employees weekly payments range from 13 to 45 cents.

Another adaptation of the group-insurance idea is a combined endowment and life-insurance plan which some employers feel is preferable to pensions since it encourages thrift. The object of these endowment plans is the accumulation, through small deposits, of a fund to provide an income later. The company contributes to the plan, giving a proportion of the premium based on years of service. For 1 to 5 years service the company pays 10 per cent, for 5 to 10 years, 15 per cent, 10 to 20 years, 20 per cent, and 20 to 30 years, 25 per cent. Some of these plans provide a cash payment after a designated number of years, beside the life and health protection insurance. In case the insured becomes permanently disabled by accident or illness the insurance becomes payable immediately in 20 annual installments.

Abstracted from the report of a survey made by the U. S. Bureau of Labor Statistics

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Technical Abstracts

Purchasing Agents Should Encourage Legitimate Competition

The primary duty of every purchasing agent is to encourage *legitimate* competition by every honorable means. It is wrong to play one manufacturer against another to the extent that whichever gets the order is fated either to lose money or to handle the business as a single turn-over that does not even carry its fair share of overhead. This applies particularly to articles requiring the use of special tools, jigs, dies or plates representing a considerable initial expenditure on the part of the manufacturer before production is begun.

Nearly all purchasers are also suppliers and must make a profit on what they sell to continue in business. It is only logical, therefore, that they grant the same opportunity to those who may be selling them and any purchasing agent who gets the reputation of inducing unfair competition among bidders will find himself paying through the nose when finally forced to go into a really competitive market. When a purchasing agent is living up to the best ethics of his profession he is at the same time purchasing for his organization, without additional cost, that most valuable of all intangible assets, goodwill.—W. W. Fulmer, *Printers' Ink*, July 7.

The Flow of Metals in Forging

The exacting demands of modern industry require the use of a great variety of high-tenacity alloys, making great reductions of section and weight possible. Yet a fundamental of all metals—the direction of flow—has received but scant attention from the engineer, and without this we cannot take advantage of the utmost service of which engineering materials are capable.

All metals and alloys are composed of crystals, and it is upon the strength and general characteristics of these crystals, together with the nature and strength of the material which is present between the individual crystals, that the strength, ductility, resilience and all other properties of engineering alloys depend.

There is no direction of grain in cast metals, as a study of the structure of ingots by means of suitable etching discloses; on the other hand all metals show a very distinctive direction of flow of their component crystals after they have been hot- or cold-worked in any way. By cutting test pieces from ingots in all directions and pulling them it will be found that the results obtained are practically the same for all, but when once steel or other metals have been worked the direction of grain becomes a very important matter, which must be given due consideration if the best possible properties and service are to be obtained from the material.

As an illustration, comparative tests have been conducted on mild-carbon and medium-carbon steel and on nickel-steel with test pieces cut parallel with and transverse to the direction of the flow. The most important feature was the great reduction of the impact figures when the tests were taken traversely, which should not be surprising when the analogy of a piece of wood is considered.

It is interesting to note that the yield point and actual textile strength figures are little different in the test pieces cut in either direction, but the figures which determine the toughness of the materials suffer the most when the longitudinal tests are compared with the transverse tests.

It is not uncommon for an engineering inspector, who does not clearly appreciate the significance of the flow of metals on working, to select his tests from parts so that they are machined into transverse tests. The likelihood is that the parts will not satisfy the specification, because the latter will have been drawn up for longitudinal tests only. This, of course, is quite unfair, and no maker of forgings or stampings should allow his materials to be thrown out for this reason.

By means of etching it is possible to reveal the fallacy of taking transverse or partially transverse tests and judging the results so obtained by standards set for purely longitudinal tests.

It is often a matter of considerable discussion to decide whether a part will be machined direct from the bar or from a forging or stamping. It is customary for cost considerations alone to determine which will be adopted, but this should not always be allowed to influence the final decision.

In the case of gear blanks there are two distinct methods. It is cheaper to make them by direct stamping from the bar rather than from individual pieces which have been cut or sheared. The latter method, however, produces a very greatly superior article. If the grain runs across the roots of the teeth then great strain will probably cause fracture, first because the impact value taken transversely is very low, and in the second place a tooth with a transverse grain must withstand all the strain, whereas when the grain is longitudinal part of the stress is borne by the center portion owing to the grain in the tooth being connected with that in the center of the gear.

There is no doubt whatever that many die failures could be prevented by a better consideration of the grain-flow of the blocks in conjunction with the shape of the stamping to be made. Punching tools are made from either forged or rolled bar and the business end of them is the ends of the fiber of the steel. With the constant working of the steel this fiber is prone to open out and so ruin the punch. To obviate this the punch should be forged to shape so that the grain roughly follows the shape of the punch and so does not allow of the grain opening so readily—*Forging-Stamping-Heat Treating*, July.

Judging the Performance of Tools and Grinding Wheels

Manufacturers of small tools and makers of grinding wheels frequently find that equipment supplied by them is complained of, when, as a matter of fact, it is the machines in which they are used and not the tools or wheels themselves that are responsible for unsatisfactory performance.

An opinion cannot be formed about the performance of cutting tools and grinding wheels apart from the machine in which they are used. Many complaints are made without thorough investigation, and without any data that would give the maker of the auxiliary equipment a clue to the real trouble. So often the machine is at fault when auxiliary equipment does not give satisfactory performance that in every case when difficulties are met with, a thorough examination should be made of everything connected with the work, including bearings, spindles, slides, leadscrews, etc., on the machine being used, as well as the clamping means, the methods of holding the work and the tools themselves. — *Machinery*, August.

Abrasive Engineering Practice in Automobile Manufacturing Plants

Accurate finishing of automobile engine cylinder bores is one of the most important production operations in the automobile manufacturing plant. At least eight methods have been followed, which include boring; boring and reaming; boring, reaming and honing; boring and grinding; boring, reaming and grinding; boring and honing; boring, reaming and honing; and boring, reaming, honing and grinding. Each method presents advantages as well as drawbacks.

In present day practice cylinders are bored with multiple tools, held in a boring head that is carried on a heavy boring bar. The objection to this method is that the heat generated by the cut is likely to spring the work, and to overcome this the operation of reaming to follow the boring is introduced. The block is permitted to cool after boring, and all bores are reamed simultaneously. While this method is satisfactory from

a production point of view, it leaves the cylinder walls in a comparatively rough state, with the result that after a few weeks of operation the ridges are worn away and the piston fit becomes loose.

The process of boring and grinding, or boring, reaming and grinding, is well established, but the practice varies. In some shops one bore is rough and finish ground before the block is located for the next bore; in others the roughing cut is taken through all bores and the block allowed to cool before being finish ground. If the holes are reamed close to size, but one grinding operation may be required. Probably 99 per cent of all cylinders are ground dry.

The honing process is used extensively; the tool employed being a head equipped with a multiplicity of abrasive stones, or hones. It must be borne in mind that the hone is not a generating tool and cannot, therefore, be depended upon to straighten a hole that is already out of line.—Fred B. Jacobs, *Abrasive Industry,* August.

Santa Fe's Apprentice System

An apprentice system for training and educating mechanics for the shop, engine houses and car yards of the Santa Fe has been in use now for twenty years. In selecting candidates for the course, practical psychology is used and reference letters are never asked for and if received, generally ignored. The boy after indenturing himself, with the approval of his parents, is placed in the shops where he starts out on a four-year course. The shop instructors, the best men in their line, take him in hand and teach him all branches of his trade, the operation of the various machines and the performance of the various jobs on the erecting floor. He is taught the best possible way of performing each job, to take care of his person, to avoid injury to himself and to his fellow workmen, and to preserve company property and material. He is taught promptness and regularity in his work and obedience to authority. He is also shown the correct interpretation of the various federal state or company rules, inspecting the work at hand through practical contact with the object.

Supplementing the practical shop instuction, apprentice schools are maintained with two required sessions of two hours each per week. Here he is taught mechanical drawing, sketching, some shop mathematics and theory of special subjects or elements such as air brakes, valve setting and the like, and is finally given an examination.

The first six months is a probationary period and during that time a reviewing body, known as the Apprentice Board, composed of the master mechanic, general foreman, department foreman, shop and school instructors, keeps in close touch with him by monthly discussions. The board also keeps track of all boys in the school.

At each mechanical point the apprentices are organized into clubs which handle all their outside activities. These clubs offer opportunities for athletics and social diversions. Club trophy prizes are offered for competition. The road claims that it has mechanics superior to the general run and that their turnover is exceedingly low. Promotion takes place from within the ranks and most minor executives are graduates from the apprentice school.—F. W. Thomas, *Mechanical Engineering,* August.

A Well-Organized Small Automobile Factory

In dealing with a small output of about ten cars per day, a judicious compromise must be made between several factors, and apart from the fact that the cost of special equipment is spread over a smaller number of parts, it is also more difficult to obtain a balanced output and an even flow of work. In this connection the work of the Hotchkiss company at St. Denis, Seine, France, is of special interest.

By an unusual method of grouping the plant so that the production machines for each unit or assembly adjoins the assembly line, which in turn terminates on the main chassis line, the entire chassis is produced under one roof with what is probably an absolute minimum of work-handling and internal transport. No attempt has been made to equip the works for the production of castings and forgings, which are bought outside together with such special components as the radiator, wheels, tires, magneto, carburetor and starting motor. Apart from these items, all components are machined complete, heat-treated, plated and polished where necessary; assembled and tested, including engine and gear box testing, in one shop.

The shop covers an area of approximately 114,000 sq.ft., and is 550 ft. long, the chassis assembly line extending throughout the greater length of this building. The body works covers an area of 240,000 sq.ft. The number of employees total 1,300, while the machine tools aggregate about 400, including those in the toolroom.—*The Automobile Engineer,* London, July.

Application of Standard Costs

The distribution of overhead through the employment of a standard burden is the best means of including this item of expense in costs. An interesting application of this is furnished by the Cincinnati Milling Machine Co. First a normal number of hours which its departments were supposed to run was arrived at. Then the allowable expense for fixed charges, indirect labor, supplies, power, etc., was established. The total amount of the standard expense, divided by the standard hours for a particular department, produced a *standard burden rate* for the department or for a group of machines in that department. To determine the cost of a part, it suffices to find the number of hours the part has been in operation in each department, multiply that by the respective standard burden rate, and add material and labor costs incurred.

A budget of monthly expenses and corresponding hours is established for each department and compared to actual expense and hours; this supplies the management with a summary of the operations of the plant and with the results achieved. The establishment of standard burden and budget systems has resulted in greater responsibility on the part of all of the department heads and foremen.

Another interesting feature is the charging of all idle time against the department incurring the expense. The charges usually are the result of a producer waiting for material, for an electrician, for the foreman or for tools. To eliminate such waste a green light has been installed about 5 ft. above the time-keeper's desk. Whenever a producer rings in on an idle time ticket, the green light is turned on. It is visible for several hundred feet through the department. The foreman, superintendent, or any executive passing by and noting the green light generally stops, ascertains the cause, and takes steps to correct the fault. By the employment of this measure idle time in the plant has been decreased approximately 80 per cent.—*The Iron Age,* July 28.

Operating Advantages of Truck-Type Switchboards

Truck-type switchboards in general are built for the same kind of service as other switchboards and are designed to carry the same switching and other equipment that has heretofore ordinarily been mounted on stationary structures. These boards are made of steel whereas the use of masonry was previously more common. Standard apparatus is used throughout on such switchboards.

Truck-type equipments are particularly adaptable for industrial plants on account of their safety features. All high-voltage parts are inclosed to protect the switchboard attendant from coming in contact with them. Such units provide a double set of simultaneously-operated connecting switches interlocked with the breaker. Primary contacts isolate both sides of the breaker when the truck is withdrawn. Low maintenance cost is possible because the repairs may be made at the time and the place that are most convenient. A spare truck may be used while another truck is being inspected or repaired. Unity of responsibility is assured with this type of equipment. Floor space can also be saved as no aisle is required behind the ordinary truck-type switchboard. Installation cost is low as the purchaser does not assemble and mount the various pieces of equipment. He simply places the housing at the desired location, connects the primary cables and the secondary control wiring at the proper location in the housing, and then pushes the truck into the housing. Due to this small amount of work to be performed, an extremely short period of time is required for installation.—F. M. Billhimer, *Industrial Engineer,* August.

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Established 1877

Elbert H. Gary

ELBERT H. GARY, better known as Judge Gary, was revered by business men. His predictions concerning future conditions, delivered periodically, were anxiously awaited, carefully studied, and strongly believed. His optimistic predictions did more than indicate his belief in the future—they fostered a confidence that of itself helped greatly to bring about the results he predicted.

President Coolidge expressed the thought of Judge Gary's many admirers when he wrote, "He stood foremost among those who find in the great private enterprises of our country an opportunity for public service as well as a medium for financial profit. He upheld the best ideals of commerce and industry and proved that success is attained in largest measure through adherence to the highest standards of American business."

The loss of Judge Gary's leadership will be felt by men in all lines of business. He was a real leader, and the proof was not alone in what he said, but also in what he did.

Basis of Payment May Influence Output

WILL a man work more on a weekly or an hourly basis of payment? A works manager recently changed his foremen from the hourly to the weekly basis, with no pay for overtime. During the following few weeks he showed them plainly that the responsibility for output and quality in their departments was entirely theirs.

The results were not unexpected. The overtime work of some of the foremen decreased and of others increased. Department overtime as a whole decreased. Within a relatively short time it was evident that some foremen, who had felt the necessity of working overtime when on the hourly basis, could give the same output during regular hours. Other foremen, with a new consciousness of their responsibilities, found themselves working overtime to prevent departmental extra work.

There appear to be advantages to the weekly basis of payment: It is likely to show up the chronic or habitual "overtimer," and reveal the overworked departments or foremen. If department heads are made really responsible, and the reward of increased pay is given as deserved, they are likely to become a thinking, leading force instead of a group that merely travels along with the machinery.

Smoother Bearings—Longer Life

VERY smooth finishes on bearings will probably be the rule before long. Some machine tool builders have added a final grinding operation that follows the ordinary "finish" grinding. It removes the "fuzz," giving the bearing a semi-lapped appearance. Many motor builders are now honing cylinders to give them a smooth finish.

When the "fuzz," or the minute high spots left by production grinding, are allowed to remain in cylinder, or on shaft, pin, or spindle, they must be worn down in service. During this wearing down or running-in process, low speeds must be used and the motor or machine does not operate at its greatest efficiency. Moreover, the reduction in size actually makes clearances more than they should be and reduces the wear life.

The life between overhaulings of machine tools, gasoline motors, steam engines, in fact almost all kinds of machinery, would be increased if their bearings were highly finished when the machines were put into service instead of being left to wear to a good finish.

Is Another Standardizing Body Needed?

TOO much standardization is rather worse than not enough. Certainly, there can be no complaint that there are not enough standardizing bodies in the United States to do the standardizing for which there is real need. As a consequence, the proposal to transform the American Engineering Standards Committee from the clearing house for standards, which it now is, into one more standard making body is not one to arouse enthusiasm.

No one questions the necessity for a clearing house to co-ordinate the efforts of the many bodies now at work and prevent duplication and consequent confusion. If the procedure by which the co-ordination is effected is too cumbersome and dilatory, by all means reconstruct it so that it will be more efficient. It is hard to see, however, what benefit can possibly accrue from giving the A.E.S.C. power to make standards. As a clearing house it exercises a quasi-judicial function that would be lost were it given power to do standardization work on its own initiative.

Shop Equipment News

Waterbury-Farrel Automatic Bolt Head Trimmer

THE Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn., has added the automatic bolt head trimming machine illustrated to its line of cold-process bolt machinery. The outstanding features claimed for the machine are: Complete separation of chips and trimmed blanks; higher speed; positive ejection of all trimmed blanks through the die; ability to trim any length without special tooling; new design of rotor hopper feed; improved transfer mechanism for carrying the blanks from the feed chute to the tools; accessibility for setting up and adjusting; and provision for either belt or direct-geared inclosed motor drive.

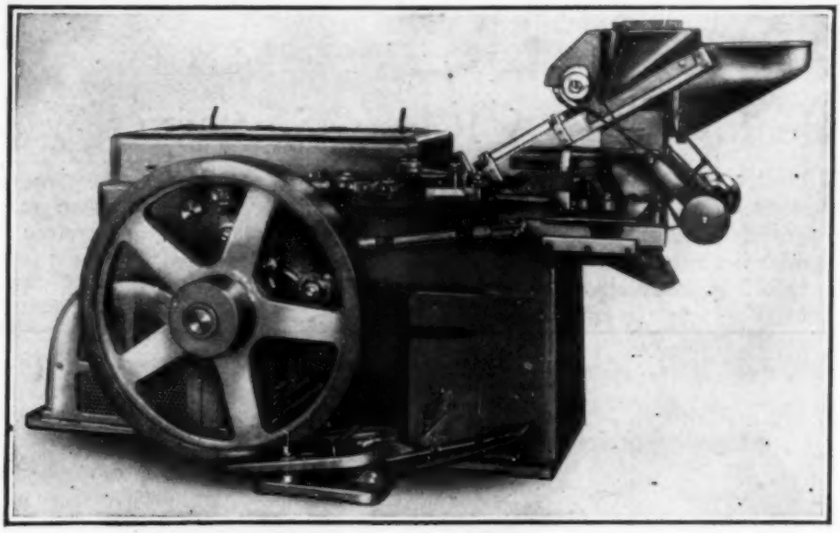

Fig. 1—Waterbury-Farrel Automatic Bolt Head Trimmer

The blanks to be trimmed are agitated in the hopper by a rotor, the blades of which pick up the blanks and deposit them in the chute. A clearing wheel having spring kickers locates the blanks correctly in the chute, from whence they slide to a finger on the transfer slide which carries them to the center of the machine. Here spring fingers grip the blank and swing it into line with the tools.

The punch is fixed in the frame and the die in a block on the reciprocating gate, a construction which makes possible the use of a positive knockout for any length of blank. The blanks are held in line with the tools long enough for the die to push them into the punch. For short blanks, a swing finger is employed to push the blanks into the punch. This finger takes up the difference in the length of blanks and is rocked out of the way as soon as a blank has started to enter the punch.

The work is trimmed by pushing the die over the projecting head of the blank. The gate is operated through a special mechanism which produces a dwell at the end of its forward position to facilitate ejecting the blanks through the die. The cutting or shearing thrust is taken by the punch through which the knockout pin operates. After trimming, the blanks are knocked out of the punch and through the receding die by means of a positive cam knockout. They then drop into an inclined chute and are delivered through a hole in the pedestal. The chips from the trimmed bolt head drop into another chute leading to an iron box within the pedestal. This box is perforated and permits the liquid to drain into a coolant tank directly beneath. From the coolant tank a constant flow of fluid is pumped to the face of the die.

The capacity of the machine is $\frac{3}{8}$ in. diam. by $\frac{3}{8}$ in. to $4\frac{1}{2}$ in. long. The production per minute is 115. The floor space required is 108 in. by 57 in. The horsepower of the machine is 5, and the net weight without motor is 7,500 pounds.

Hisey Drilling Stand

The Hisey-Wolf Machine Co., Cincinnati, Ohio, has brought out the drilling stand shown in the illustrations, which can be supplied for post or wall mounting, or in the conventional bench design. In Fig. 1 is

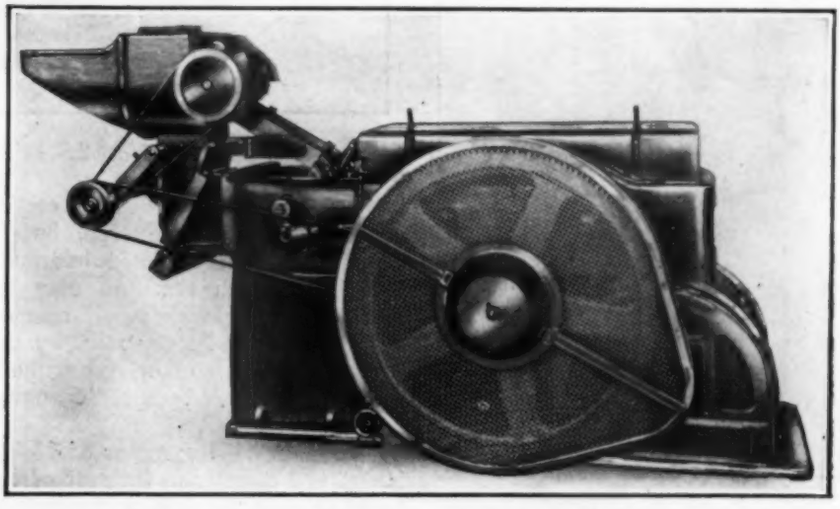

Fig. 2—View of drive side of Bolt Head Trimmer

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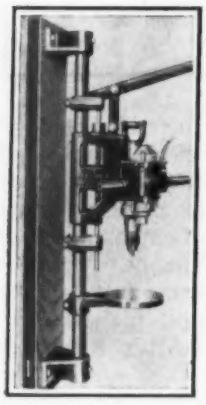


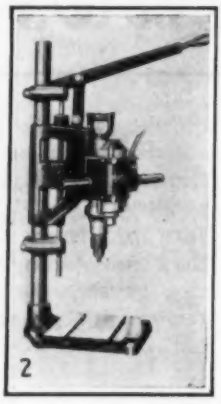


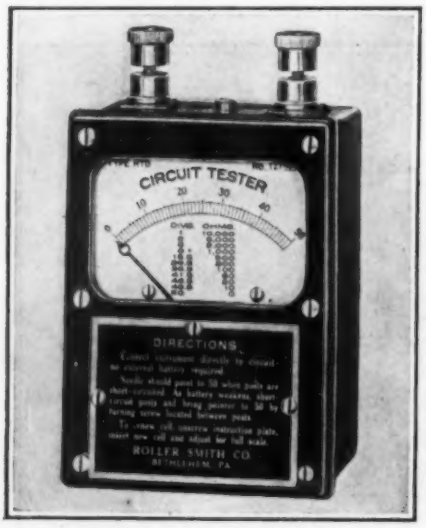
Fig. 1—Hisey Post Drilling Stand. Fig. 2—Bench Drilling Stand

shown the post drilling stand, and in Fig. 2 is illustrated the bench drilling stand.

These drilling stands are made for all sizes of Hisey electric drills from ¼ in. to ⅞ in. capacity. They are designed so that the portable drills can be attached without moving any part of the machine. This feature is claimed to be a great time-saver, and a protection against loss of parts. The supporting bracket and the electric drill housing are machined on each end to insure perfect alignment of the drill in the stand.

Roller-Smith Type HTD Circuit Tester

The Roller-Smith Co., 233 Broadway, New York, has developed the Type HTD circuit tester for the purpose of providing a small and reliable device for circuit testing and approximate resistance measurement. The circuit tester is recommended for use in preference to magnetos and a.c. bell-ringing devices because of its accuracy of indications under all conditions and its lightness and compactness. Indications on the circuit tester are claimed to be never misleading, whereas the alternating current generated by the hand driven magnetos will often cause the bell to ring when circuits include condensers, even if the circuit is not complete.



Roller-Smith Type HTD Circuit Tester

The instrument consists of a small high-grade d'Arvsonal type D.C. voltmeter connected in series with a small dry cell. The instrument pointer will indicate full scale when the terminals are short-circuited. The higher the resistance of the circuit under test, the lower the scale reading will be, and thus, in addition to showing whether or not a circuit is complete, an approximate idea can be obtained of its ohmic resistance. The scale is divided into fifty uniform divisions, and directly below the scale is located a chart, by reference to which resistances up to 10,000 ohms may be calculated.

The instrument is inclosed in a heavy sheet metal case with a black finish, and is equipped with nickel-plated binding posts. The instrument measures 4½ in. x 3 in. x 1½ in., and its weight is 19 ounces.

Heald No. 25-A Rotary Surface Grinder

THE Heald Machine Co., Worcester, Mass., has brought out an improved rotary surface grinding machine intended for rapid production work in large sizes. In general it is a development of the earlier machine of the same type, but is equipped with the Heald hydraulic drive, by which the ram may be reciprocated at any desired rate of speed up to 50 ft. per min. by the adjustment of a single lever without gears or stepped speed-changing mechanism.

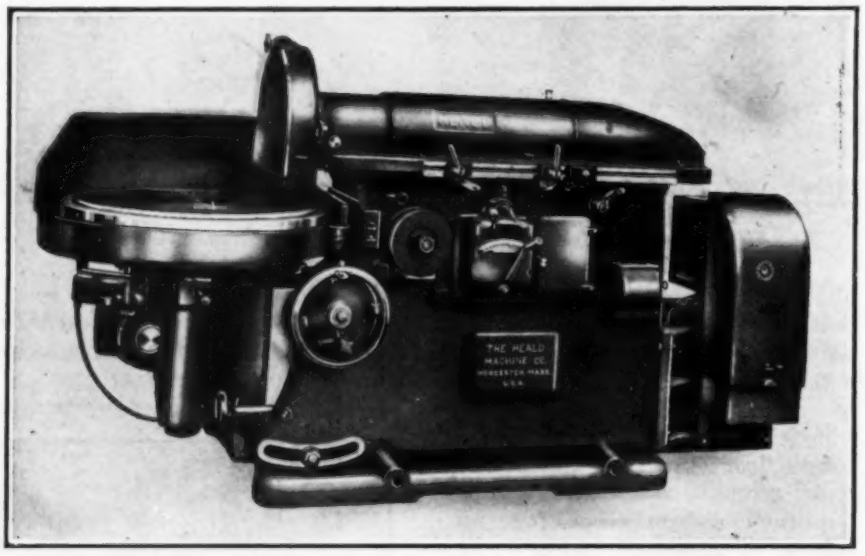


Fig. 1—Heald No. 25-A Rotary Surface Grinding Machine

The main driving motor of 15 hp. is attached directly to the rear of the base, driving, through a compensating coupling, a shaft from which is transmitted the power to drive the wheel spindle, the oil pressure pump of the hydraulic drive, and a circulating pump to deliver coolant to the work and wheel when desired. This driving shaft runs on ball bearings.

The ram travels on flat and V-ways which are at all times covered, and thus protected from dirt and abrasive dust. The wheel spindle runs on ball bearings. Power to drive the wheel spindle is taken from the main driving shaft through a 6-in. endless belt that runs upon drums to accommodate itself to the end movement of the ram.

The reciprocating movement is controlled by a throttle and a revers-

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ing valve, both actuated by levers contained in a box attached to the operating side of the machine in position to be reached conveniently by the operator and to be moved by the adjustable reversing dogs on the side of the ram. Oil for the hydraulic mechanism is contained in a chamber in the base casting.

The vertical slide is dovetailed to a swiveling bracket on the front of

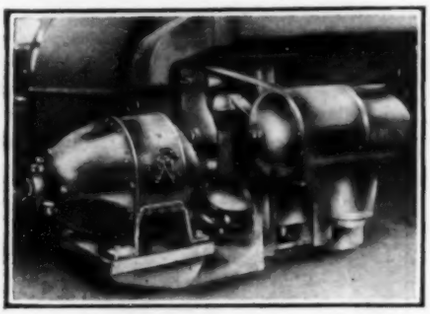


Fig. 2—Chuck-driving motor and power transmission

the base, thus providing angular adjustment in a vertical plane to grind work convex or concave. The amount of the angular adjustment is 15 deg., maximum, but the available angle depends upon the size of the chuck and the height of the work.

Vertical adjustment of the chuck is obtained through a large handwheel conveniently located with reference to the operating position. Graduations on this wheel permit adjustments to be made in increments of 0.0005 in. Automatic vertical feed can be applied to this mechanism.

The chuck spindle is driven by an independent variable-speed motor under push button control from the operating position. Power is transmitted from the motor to the spindle by an endless belt. The spindle runs in a radial ball bearing at the top and a bronze sleeve bearing, adjustable for wear, at the bottom. The weight of the revolving parts and the thrust of the grinding wheel is sustained by a broad bearing under the chuck flange. The chuck is bolted to the flange instead of to the usual form of threaded collar, or faceplate.

An adjustable wheel-truing diamond, located in the chuck guard, is supplied on order with all machines up to the 24 in. size. By means of the micrometer graduations the operator is enabled to control his sizes within very close limits.

The machine is available in three sizes, with 16-in., 24-in., and 30-in. chucks, swinging 20, 29 and 36 in., respectively. A 15-in. hp., 900-r.p.m. a.c. motor is recommended for the main drive of all machines, and a 2-hp., variable-speed d.c. motor with a range of speeds from 700 to 2,100 r.p.m. for all three chuck devices.

The net weights of the three machines are approximately 5,500, 6,500 and 7,000 lb., and the floor spaces occupied, including coolant tanks are 105x66, 117x66, and 117x66 in., respectively.

Taylor-Winfield Automatic Welder for Automobile Bodies

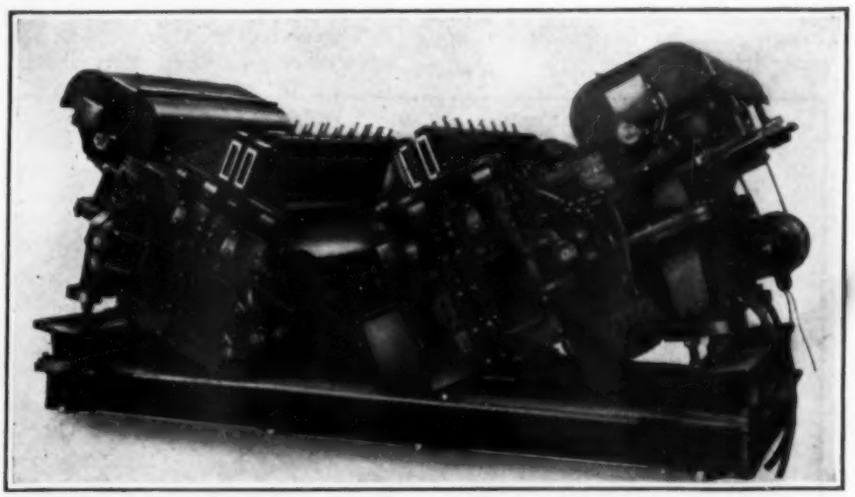
THE Taylor-Winfield Corporation, 12 Atlantic Street, Warren, Ohio, has brought out the welder illustrated, which is designed for welding the backs of automobile bodies and the two side panels. The capacity of the machine is 18 gage sheet, 36 in. wide by 72 in. in length.

The back of the automobile body is clamped in the center of the machine by means of a toggle operated by air, and each side panel is clamped at the right and left hand side by means of the same type of toggles operated by air. Each set of outside heads are worked independently by means of auxiliary switches operated by remote control switches, so that one side is started and as soon as the weld is completed the opposite side is then started. After unclamping, the entire back of the car is lifted out as a unit. Hence, the welding of the complete automobile body is accomplished in one set up.

Both upper and lower dies in all the clamping heads are removable, so that various shapes can be accommodated and replacements made. All pins and bushings on the clamping heads are hardened and ground, and the upsetting slides are faced with hardened steel plates. The angle adjustment possible on the machine in order to accommodate various shapes of bodies is from 15 to 35 deg. from the horizontal. The welding centers are adjustable from 34 in. to 50 in., according to the degree that the machine is set. The machine is equipped with two 200-kw. water-cooled transformers and the power is provided by two 3-hp. motors. The upsetting on the machine is automatic. The machine measures 13 ft. 6 in. by 6 ft. 9 in., and has a height of 72 in. The approximate weight is 20 tons.

Thor High-Frequency Electric Drill

The Independent Pneumatic Tool Co., 600 West Jackson Boulevard, Chicago, Ill., has brought out a line of electric tools with squirrel-cage motors and operating on 180 cycle current. The type of motor employed in these tools eliminates armature windings, commutators and brushes which is claimed to have been the



Taylor-Winfield Automatic Welder for Automobile Bodies

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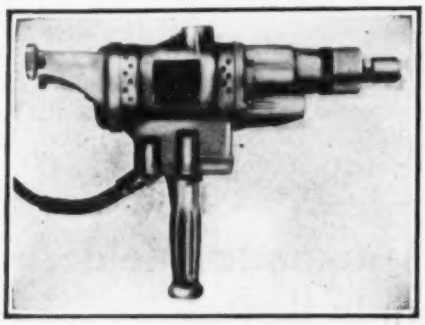


Thor High-Frequency Electric Drill

seat of trouble in universal-motor tools. The Thor rotor uses solid copper bars riveted and welded in position. The gears are made of special high-grade steel to withstand harsh service. The stator case and the gear case are of heavy aluminum.

One of the important features claimed for this line of tools is the constant speed, from no load to peak load, there being no slip in speed under load with these tools as compared with the universal motor tools, thus greatly facilitating production. Another feature is the size and weight, which is about one-third that of a 60-cycle current tool, and results in easier handling by the workman, assuring increased production.

To use the high frequency tools it is necessary to install a frequency changer to step up the current to 180 cycles, but the advantages gained are said to be so great that any shop having ten or more portable tools in use will find it profitable to do so.

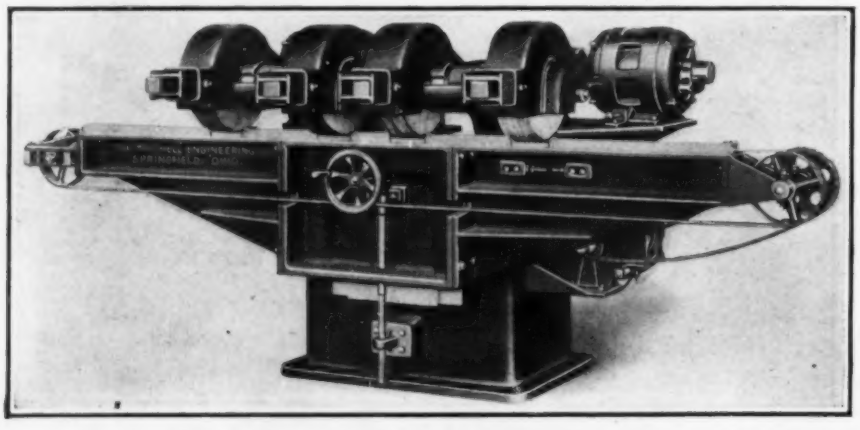
The Thor line of induction type motor 180 cycle electric tools includes drills, reamers, screw drivers, tappers, nut setters, grinders and sanders. The tool illustrated is a high-frequency drill having a weight of 24 lb. and a speed of 380 r.p.m. It is used for $\frac{7}{8}$-in. drilling and $\frac{13}{16}$-in. reaming, and is also suitable for nut setting up to $\frac{3}{4}$ inch.

Mitchell Automatic Strip Buffing Machine

THE Mitchell Engineering Co., Springfield, Ohio, has just brought out the automatic strip buffing machine illustrated, which is adapted for buffing automatically strips up to 3 in. wide. To operate the machine it is only necessary to lay the strips on the conveyor belt at the left-hand end of the machine. The belt then carries the strips past the wheels and discharges them at the right-hand end. The rate of feed is dependent upon the nature of the work being buffed. Changes can be made by changing the sprockets on the conveyor drive.

The machine is provided with four buffing wheels. Each pair of wheels is driven by a 10 hp. motor controlled by magnetic switches and operated by push buttons. Each pair of wheels rotate in opposite directions, the method of buffing being for one pair of wheels to engage the strip from the center to one outer edge, and the other pair of wheels from the center to the other outer edge. This is claimed to give a much better finish than if the wheels were operated on the work longitudinally.

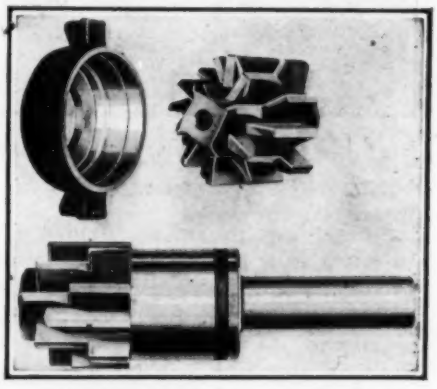
The conveyor table may be raised or lowered to keep the wheels in proper contact with the work. Each pair of wheels with its respective driving motor is a separate unit, and is mounted on the base of the machine to permit moving it in or out, dependent on the width of the strips. The machine weighs approximately 6,000 pounds.



Mitchell Automatic Strip Buffing Machine

Eclipse Multidiameter Cutter

The Eclipse Counterbore Co., Detroit, Mich., is manufacturing a special line of multidiameter, or multiple operation, cutters designed to bore or face from two to eight surfaces at the same time. One of the cutters, with a sample of the work done, is shown in the illustration. The design of the cutter enables it to be sharpened without losing its form. It is thus possible to machine the various surfaces at one operation without resetting. The tool is intended for production work on boring, facing, and chamfering, and can be made specially to accommodate a great variety of work.



Eclipse Multidiameter Cutter

EC&M Type SA Lifting Magnet

The Electric Controller & Mfg. Co., Cleveland, Ohio, has put in production the Type SA lifting magnet shown in the illustration. A coil spider of composite construction, with a body of cast steel and a flange of cold-rolled brass, provides greater strength and better lifting capacity as compared with the one-piece cast-brass spider. The outer pole shoe has also been extended upwards to fit against a machined surface on the outside of the magnet housing, giv-

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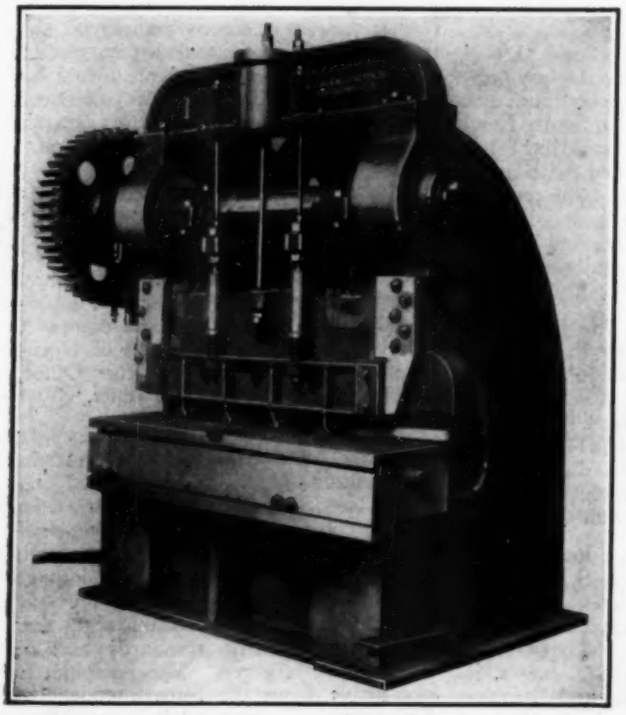
EC&M Type SA Lighting Magnet

ing greater strength to prevent pole shoe breakage.

A steel plate ½ in. in thickness is bolted at the top of the magnet to prevent injury to the incoming leadwires from the crushing effect of the crane hook and chains. The Type SA lifting magnet is claimed to be capable of outlifting and outlasting previous designs.

Long and Allstatter Improved Squaring Shears

The Long and Allstatter Co., Hamilton, Ohio, now furnishes, as a standard feature on the No. C size squaring shears and smaller, an improvement that allows one end of the blades to remain open a little more than the thickness of the material being sheared, so that a sheet longer than the blades themselves can be cut in two stages without nicking or tearing in the first pass. In this way it is said it is possible to cross-cut the full width between the housings or to slit any length without change of the blades, so that considerable time is saved in such operations.



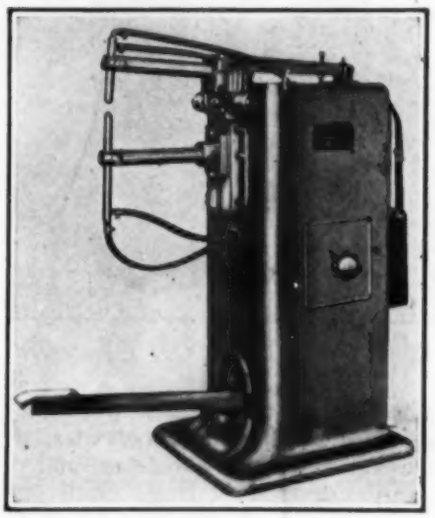
Long and Allstatter Improved Squaring Shears

Thomson Spot Welder, Series No. 180

THE Thomson Electric Welding Co., Lynn, Mass., has brought out the spot welder illustrated. The welder is rated at 7½ k.w., 10 kva. for continuous production. It has an extra "high" tap that can be used for intermittent welding if extra capacity is needed. This high tap may increase the load as high as 14 kw. 17 kva. The transformer is of the air cooled type.

The capacity of the machine is for 2 pieces of No. 16 gage iron and steel for average production. Two pieces of stock ⅛ in. thick can be welded at a slow rate of speed as an overload. Aluminum and brass up to 22 gage can be welded with special Elkonite dies.

The horns are made in two throat depths 12 in. and 18 in., and are either solid bar copper, or water cooled cast copper. A drop plate allows vertical adjustment of 4 in. When the lower horn is dropped the lower die point can extend 8 in. above the top of the horn. The dies are either water cooled or of solid copper. The welder is equipped with a line break switch for 220-volt service mounted on the back. With this type of switch the current cannot be turned on until the dies touch the work. A wall contactor, 440-550 volts, can also be furnished. The foot treadle swivels to either side, and is adjustable for length by loosening one set screw. Oiling facilities for all bearings are easily accessible, and the machine is fully covered with removable guards.



Thomson Spot Welder, Series No. 180

The machine covers a space 24 in. long by 20 in. wide, and is 48 in. high. The length of the horns, plus 10 in. for treadle overhang, added to the length is the working space for the welder. The weight of the machine is 700 pounds.

The welder is claimed to be of substantial design, with finish and workmanship in line with high-grade machine tools. Models 180 S 12 and 180 S 18 have throat depths of 12 in. and 18 in. respectively, with solid copper dies. Models 180 W 12 and 180 W 18 have throat depths of 12 in. and 18 in., and water-cooled dies.

Roller-Smith Type COM Ohmmeter

The type COM Ohmmeter is a form of slide wire instrument designed by the Roller-Smith Co., 233 Broadway, New York, N. Y., for the rapid measurement of coils and resistance units on a quantity production basis. The instrument is entirely self-contained in a case of black walnut. The overall dimensions are 5¼x9¾x4¼ in. There are four ranges of 0.5 to 50, 5 to 500, 50 to 5,000, and 500 to 50,000 ohms. The instrument oper-

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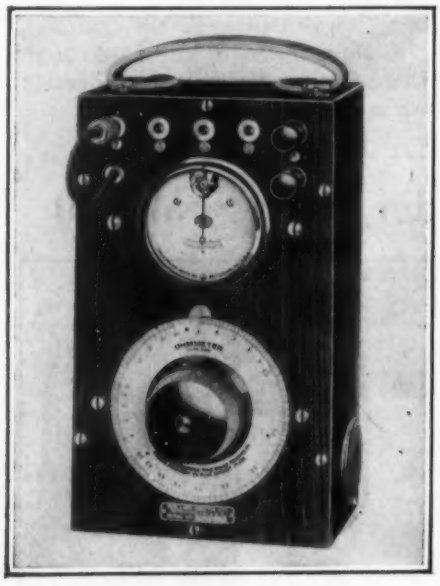

Roller-Smith Type COM Ohmmeter

ates on the principle that when the galvanometer needle balances at zero the value of the resistance under measurement can be read directly on the dial. Resistances may be read within 1 per cent of their true value.

Trade Catalogs

G-E Products. The General Electric Co., Schenectady, N. Y., recently released a large number of circulars describing various products. Those on controller equipment include semi-automatic reduced voltage starters for synchronous motors, push- and pull-button control switches, automatic station control equipment, duplex controllers, and automatic switching equipment. Among the miscellaneous equipment described are frequency changers, electric furnaces, cartridge heating units and electric melting pots. The circulars are all well illustrated and are in loose-leaf form of convenient letter size.

Transmission Equipment. Golden's Foundry & Machine Co., Columbus, Ga., has published Catalog No. 18 on its transmission machinery. The book contains about 200 6x9-in. pages, and is bound in stiff covers of imitation leather. It is profusely illustrated throughout. The line includes hangers of various types, shafting, pillow blocks, couplings and miscellaneous equipment. A large part of the book is devoted to cast-iron pulleys and rope sheaves, including considerable engineering data.

Toolholders, Pipe Tools, Ratchet Drills, Drop-Forged Wrenches. The Armstrong Bros. Tool Co., 317-357 No. Francisco Ave., Chicago, Ill., has issued Catalog B-27, describing the tools made by the company. The catalog contains one hundred seventy-three 4x6 pages, and illustrates each type of tool described. Besides the regular line of toolholders, the catalog shows tool racks, steel tool cabinets, special tools for lathes, planers and shapers, lathe dogs, clamps, drill sockets, ratchet drills, wrenches, and a line of pipe tools.

Tools. The American Swiss File & Tool Co., Elizabeth, N. J., has issued a catalog covering the line of tools made by this company. The catalog contains twenty-one 4x8½-in. pages, illustrated with each type of tool described. The tools include screwdriver bits, chisels, countersinks, punches, stone drills, ratchets, screw drivers, valve grinders, blowpipes, bearing scrapers, socket wrenches, knurls, emery wheel dressers and box hooks.

Speed Reducer. The Link-Belt Co., Chicago, Ill., has just issued Book No. 715, describing the Link-Belt Sykes herring-bone speed reducer. This speed reducer is made in various sizes, which are described and illustrated in the booklet. The booklet also give diagrams showing the important dimensions of the reducers, and tables of horsepower for single and double reduction.

Lift Jacks.. Black Hawk Mfg. Co., Milwaukee, Wis., has put out a large size 9¾x12-in. pamphlet, describing its line of hydraulic oil-power jacks. The book illustrates in colors lifting jacks of various capacities up to the 75-ton industrial jack.

Lathes. The South Bend Lathe Works, South Bend, Ind., has just published Catalog No. 88, describing and illustrating the new model South Bend lathe. The catalog measures 8x11 in., and is profusely illustrated with halftones and diagrams of the lathe and the various parts. A section is also devoted to small tools for the lathe, and general information on shop equipment and set-up for the lathe.

Internal Grinders. The Ex-Cell-O Tool & Mfg. Co., 1469 East Grand Blvd., Detroit, Mich., has just issued a catalog illustrating and describing internal grinders and spindles. The catalog contains thirty-eight 8½x11-in. pages, illustrated with cuts and diagrams of the high-speed and heavy-duty grinding spindles manufactured by this company.

Generator Voltage Regulators. The General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-709, describing its line of automatic generator voltage regulators. The bulletin contains thirty-two 8x10½-in. pages, illustrated with photographs and diagrams of the equipment described. Tables are also given showing the principal dimensions, weights, and electric factors of the various equipment.

Tube Couplings. The Parker Appliance Co., 10320 Berea Road, Cleveland, Ohio, has published a 16-page descriptive bulletin of the Parker tube couplings and fittings for copper tube underground water service lines. Besides giving complete descriptions and illustrations of the various types of couplings made by the company, the booklet contains general information regarding specifications for tube couplings and fittings.

Pamphlets Received

Redesign Engineering. The Fusion Welding Corp., 103d St. and Torrence Ave., Chicago, Ill., has issued a 24-page booklet under the above title. It is descriptive of fusion welding, and contains chapters on the welding generator, welding rod, protection for the welder, arc welding accessories, and problems in design to meet welding conditions. The booklet is illustrated, and is a reprint of an article by J. B. Green, president of the company.

Automotive Transportation and Railroads. The Commission on Commerce and Marine of the American Bankers Association, New York, has published a 4½x8-in. booklet containing 83 pages under the above title. The booklet is a study of relationship now developing between highway and rail transports. It takes up in detail comparative investment in highway and rail transportation, persons employed in transport, taxation, and many special features such as freight transported by motor truck. The booklet contains numerous tables, giving specific data on automotive and railroad transportation.

Calibration of a Divided Scale. The Bureau of Standards, Washington, D. C., has published circular No. 329, giving in detail a method of calibrating a divided scale, together with references made to other methods which have previously been published. The pamphlet is sold by the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents.

Testing of Line Standards of Lengths. The Bureau of Standards, Washington, D. C., has published circular No. 332 under the above title. The circular outlines the methods used in the comparison and standardization of line standards of lengths, and gives the basis of such measurements in the United States. Information regarding the testing of line standards and of metal tapes is given. The pamphlet is obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 10 cents.

NEWS OF THE WEEK

Economists and Workers Discuss Unemployment

THE problem of unemployment and the best methods of stabilizing industry throughout the country as a means of reducing the number of men thrown out of work during seasonal declines, were discussed by college professors and workers in various lines of industry at a conference held at Bryn Mawr College on July 30 and 31. The conference was under the joint auspices of the Central Labor Union of Philadelphia and the Labor College and was a continuation of the program carried out last winter when the elimination of waste in industry was the topic of discussion.

No program for solving the problem was set up, but those attending the sessions left with a belief that the discussions had done much good and that the meeting would lead eventually toward a method of solving the difficulty. The discussions were led by H. E. Bartow, secretary of the Pierce School of Business Administration, Philadelphia, who took a more pessimistic view of the situation than did Dr. Sumner H. Slichter, professor of economics at Cornell University, who challenged the allegation that overproduction is the cause of unemployment. Instead, he said, there is too much hoarding instead of consumption. Labor unions should be continually called into conference by leaders of industries for information regarding business conditions and should discourage excessive accumulation of inventories. Public works should be planned so that such work could be done in times of other business depression.

Too Much Idle Equipment

Such distribution of the national income as will make greater consumption possible was urged by Charles H. Chase, professor of marketing in Ohio State University. He believed such a program would prevent the waste of having vast amounts of capital tied up in machines that stand idle and industries equipped beyond need. The clothing, shoe and automobile industries, he believed, could produce twice as much as they do, with their plants just as they are now, if there were a more even distribution of national income as a means of increasing consumers and consumptive power.

Miss Mary van Kleek, director of the industrial department of the Russell Sage Foundation, told the conference that the American Federation of Labor's new program for publication of unemployment statistics will be a very great help to industry and will work toward a solution of the unemployment problem.

Edward E. Hunt, secretary to Herbert Hoover, had a paper read by proxy.

Mr. Bartow expressed the opinion that one of the greatest factors that would work toward stabilizing employment is high wages, but added, however, that there are times when employer and employee should co-operate to the extent that when business slows up the worker should take a lesser wage. He remarked: "Perhaps our prosperity of the last few years has blinded us to the fact that unemployment has been gradually increasing, until now it has reached a level high enough to awaken us from our indifference."

"Statistics show that factory workers have decreased each year since 1919. Fewer persons are employed in agriculture, the railroads have reduced their forces materially, the number employed in Federal service is much less; the automobile industry is employing many thousands fewer, and shipbuilding is now a decadent industry. Diagnosticians believe that after the brief slowing down of the summer there will be considerable improvement during the fall and winter. While there is no panic, business at present certainly is not so good as some would have us believe, and there is no apparent foundation for some of the most optimistic predictions."

Joachim Wins Diesel Award for Paper

Announcement is made that W. F. Joachim, mechanical engineer at the Langley Memorial Aeronautical Laboratory, has been selected to receive the Rudolph Diesel Award for 1927, consisting of a suitable certificate and a cash prize of $100, for his paper entitled "Oil Spray Investigations of the National Advisory Committee for Aeronautics," which was presented at the Oil Power Week meeting at Pennsylvania State College. The committee of award consisted of F. Thilenius, of the Prairie Pipe Line Co.; F. G. Hechler, professor of engineering research, Pennsylvania State College; and R. Miller, of the Ingersoll-Rand Co.

The Rudolph Diesel Award, established in honor of the man whose name is so closely connected with the modern oil-engine, is given annually in connection with the activities of Oil Power Week, for the best written contribution toward the advancement of oil engines delivered at any of the meetings held throughout the country. In this year's celebration of Oil Power Week, 106 meetings of national technical societies were held in 31 states; 88 different papers were presented, all of which had been especially prepared for the occasion.

Textile Machinery Show At Edinburgh

A textile machinery exhibition will be held at Edinburgh, Scotland, from Oct. 5 to 15, according to Consul Harold D. Finley, Edinburgh. This exhibition will be one of a series which have been held in the British Isles, those of 1911, 1914 and 1925 being located in Manchester and the 1923 and 1926 shows at Leicester. The machinery displayed will include machines and appliances for use in the woolen, tweed, knitting, flax, linen, jute, carpet, Madras curtain and finishing trades.

Edinburgh is within easy reach of many centers of interest to the textile trade. The Scottish border south of the city is the seat of the large Scottish tweed industry. The nearby towns of Hawick and Galashiels are important knit goods centers. To the east of Edinburgh are cotton spinning and manufacturing interests, together with large bleaching, dyeing, printing and finishing plants. Fifeshire, across the Firth of Forth, is the center of a table linen industry, while a little further to the north is the largest jute industry in Great Britain, centering about Dundee.

British exports of textile machinery during the first six months of 1927 showed an expansion of 6,453 tons over the corresponding period of 1926, a result mainly attributable to larger shipments to Russia. Exports also increased to Japan, China, the United States, Canada, the British East Indies and the Netherlands. In making comparisons it will be remembered that the British coal strike probably played a part in reducing exports for the first six months of 1926. Substantially the whole of the increased exports occurred in machinery for spinning and twisting, equipment of other descriptions recording but little change.

Gear Manufacturers Elect

The executive committee of the American Gear Manufacturers Association met in Cleveland on Aug. 19 to elect officers for 1927-28 and to select the time and place for the next annual meeting of the association. It was decided to hold this meeting at the Mount Royal Hotel, Montreal, Canada, on three days —Oct. 20, 21 and 22.

All the present officers of the association were re-elected. They are: E. J. Frost, president; A. F. Cooke, first vice-president; B. F. Waterman, second vice-president; Charles F. Goedke, treasurer; and T. W. Owen, secretary.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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THE business men of the United States are looking hopefully forward to the autumn, and are much gratified to read that Chairman Eugene Meyer, of the Federal Farm Loan Board, advises the non-speculative purchase of farm lands because the farmers should realize a billion dollars more for this year's crops than they obtained for last year's production. This is good news indeed, and it has helped to antidote the depressing effect of Colonel Ayres' announcement that "Our prosperity is getting tired."

Curiously enough, Colonel Ayres' pessimism and Chairman Meyer's optimism have the same basis. It is the small crops that are indicated by the government estimates. The Colonel appears to believe that short crops menace prosperity because they provide less food and clothing, generate less business, and employ fewer people, while Mr. Meyer seems to think that a falling off in the agricultural production is a blessing if it enables the farmer to get higher prices for a smaller yield.

The economist will probably agree with the Colonel, while the bankers who have debts to collect will endorse Mr. Meyer's view, provided those who owe the debts have made fair crops.

But while we wait for the prosperity predicted, we cannot shut our eyes to the slight recessions that are reported in many lines. Car loadings continue to show a decrease of about 5 per cent. S. W. Straus & Co. report that July building permits in 489 cities contemplate an expenditure that is 15 per cent less than the same month in 1926. In their fall and winter catalog, Montgomery, Ward & Co. quote prices that are 6 per cent under last year. The Federal Department of Labor says that unemployment showed a substantial increase in July, particularly in the automobile industry, and this is confirmed by preliminary estimates, which put the automobile production in August at about 20 per cent under last year.

The trade in cotton and woolen textiles is also satisfactory, although the gyrations of the cotton market have recently interfered with the distribution of cotton goods. Opinions as to the value of cotton itself are widely divergent. Southern receipts are increasing, and about 4,000,000 bales will probably be ginned by Sept. 15. It remains to be seen whether this quantity can be sold at above 20 cents a pound.

Sugar has not varied more than one or two points the whole week. In any other market such stolidity would have been accepted as evidence of great strength. Some Havana cables assert that President Machado will announce his policy in respect to crop restriction within thirty days.

Stocks of coffee in the interior warehouses of Santos are now increasing rapidly. Plantation deliveries are running at the rate of 2,000,000 bags a fortnight, and it is a question of whether the dam of governmental control can withstand the pressure of this accumulation. If not, coffee will have to decline to a price that will insure its normal distribution.

Rubber has been steady at around 36 cents, and the American rubber pool appears to have been temporarily successful in stabilizing the price at that level.

The grain markets have fluctuated within narrow limits. The crop news is still bullish, but it seems to have been pretty well discounted, and most speculators appear to have bought about all the wheat and corn they care to carry. If they are correct in their estimates of the supply and demand, higher prices may be seen later on.

The steel industry can best be described as slack but hopeful, and much the same thing may be said of copper, which is a shade lower. In the securities market, easy money has continued to be a shock absorber, and prices have been fairly well maintained. Judge Gary's death was without effect, although the advance in U. S. Steel that followed was mistakenly construed by some as reflecting a belief that the stockholders would be more liberally treated by his successor, who has not yet been selected. The railroad shares are, if anything, lower, on smaller net earnings and the apparent hopelessness of getting the Interstate Commerce Commission to approve of any of the consolidations proposed.

Stock Exchange seats are slightly lower, and both brokers and customers appear to be prepared for a period of relative quietude. Whether it will be ended by a decline or an advance depends upon the course of general business in the autumn. If the expected recovery arrives on time, we may see a revival of Stock Exchange speculation, but as a condition precedent, there will probably be a reaction in broker's loans, which are within $1,360,000 of the peak.

Our foreign trade for July shows an excess of exports valued at $16,000,000. A statement issued by the Department of Commerce estimates our net growth as a creditor nation during 1926 at $557,000,000.

WHAT'S DOING IN INDUSTRY

MANUFACTURERS of machinery, and their dealers and agents, are still struggling under the burden of summer dullness. Sales in most of the larger industrial centers are below normal, even for August, but the presence of some active inquiries has given a more encouraging tone to the market. It is the general opinion that the coming fall season will bring a revival of sales.

DETROIT still offers the most promising field, with several automobile manufacturers known to have re-equipment programs under consideration. The present sales volume in Chicago is not large, but prospects are better than in several weeks. Cincinnati reports a slight gain in sales with a good volume of inquiries on record. Slight improvement in Indianapolis has bolstered up the August volume somewhat.

CANADA reports sales holding up remarkably well, with building construction, railway and power enterprises buying considerable machinery. Sales are quiet in the South, but improvement is expected when the better crop prices are definitely known. Manufacturers in New England are busy, but new business has slacked off. Scattered orders for single tools is the extent of activity in New York.

DESPITE the slight recessions that are reported in many lines of trade, there are unmistakable signs of a recovery of prosperity in the autumn. Economists differ as to the signs, but they all agree that the outlook is better.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

INDIANAPOLIS

Some improvement has been noticed in the last two weeks in demand for machine tools and machinery, and many signs indicate that the summer dull season is passing. The automobile demand is one of the dull spots and little chance for business with this industry is seen here until later in the fall.

The railroad demand, which has been very poor here for weeks, is causing concern. Roads doing business in Indiana are cutting their repair and replacement programs. A demand is reported for small lathes and other equipment especially designed for manual training work in the high schools and universities in the state. Most of this business will be placed before school begins next month.

Inquiries are being received in increasing numbers from the coal fields, particularly for special equipment for use in strip mine operations. Inquiries also are being received from several of the shaft mine coal companies.

NEW ENGLAND

Machinery buying during the past ten days has slackened and the explanation offered is that buyers are absent on vacations and the decline is entirely due to the season. Optimism is the prevailing sentiment and a very active fall is anticipated.

Rubber-making machinery is in good demand at the Farrel Foundry and Machinery Co., in Ansonia. This company and the Birmingham Iron Co., of Derby, Conn., will be merged as of July 1, if the stockholders approve at a special meeting on Sept. 20. Both plants are operating at capacity and have orders well booked ahead.

SOUTHERN DISTRICT

Though machine tool sales continue quiet in the Southern district, distributors state that inquiries have improved in the past two weeks, and that the outlook for late summer and fall business is even better than it has been. One of the reasons for the excellent outlook this year is the fact that higher prices are prevailing for nearly all of the leading Southern crops, especially cotton, which is expected to greatly improve the general business trend in the Southeast the latter part of the year, and coincidentally bring about a general improvement in the sales of all lines.

A number of fair sales in the woodworking equipment field were reported in the past two weeks, and though this business has been somewhat spotty in the last three months total sales have exceeded those of last year, with the outlook particularly good for the remainder of the year. There are also better sales reported to building contractors the past few weeks due to a revival of construction activity in this section, with a good fall trade in prospect.

Heavier equipment sales to railroads are a little off compared with last season at this time, but comparatively normal. Present indications do not seem to promise any improvement to speak of the next several weeks, though normal business is in prospect. Smaller shops and service stations are still inactive, placing a few orders for used and rebuilt machinery but hardly any orders in the new equipment line.

CINCINNATI

Approximately one-third of the machine tool manufacturers in the Cincinnati district report that their sales have shown a slight increase in the past week, an equal number report that their sales were about the same as in the previous week, and the remainder report that there was a slight falling off. Taking the market as a whole, however, and striking an average, it seems that the manufacturers made some gain over the previous week.

While a portion of the orders received in the week called for two or more tools, the great majority called for single tools, for replacement purposes. The week's sales were well scattered over the country and were well diversified, the principal buyers being general machinists and miscellaneous users. The Citroen company in France placed an order last week for 87 multi-cut lathes with the Le Blond firm in this city.

The majority of manufacturers, as well as the majority of the selling agents, report that in the latter part of the week the inquiries increased. These came from all classes of users, were for all types of tools and came from all parts of the country. As the greater part of the week's inquiries were for single tools and replacements, it is thought that these will continue to be the backbone of the market.

NEW YORK

A few scattered orders from large industrials, and some substantial export business, makes up the bulk of current sales activity in this market. Many dealers and manufacturer's agents complain of the dullness in many phases of the trade, but it is generally agreed that prospects for a good volume in the approaching fall months are very encouraging.

The inquiry volume has slacked off somewhat, no large lists having appeared in recent weeks. Most of the orders being placed at this time are the result of much previous missionary work on the part of sellers. Two orders were recorded last week for large axle journal turning lathes, one for the New York Central R.R. and one for the Kansas City Southern.

Steel fabricating plants and manufacturers of structural steel and building hardware are busy and have taken on some new equipment in the way of brakes, presses and metal cutting machines.

DETROIT

The machinery and machine tool trade in the Detroit district is still suffering from the summer slump. There is little action and that little is spotty and accidental, but dealers are not at all pessimistic. There has been a general feeling all summer that business would be good before the end of the year and that feeling is stronger now. The attitude of most dealers is decidedly cheerful.

Dodge, Oakland, Studebaker, Ford and Chevrolet are expected to place orders within the near future. The Dodge plant is undergoing a number of changes in preparation for the new light six. The new four is going better than officials anticipated and plans are being made for large production. The new Oakland model is going well and will probably necessitate some purchases.

Employment picked up more than 2,000 in the week before last and almost as much last week. A slow, regular improvement is being felt in the industrial field. The announcement of the plans for the new Ford car made by Edsel Ford seem to have had a beneficial effect on general business conditions.

CHICAGO

Indications are not lacking that increased activity in the machine tool trade may be looked for in the very near future. While actual sales are not to any extent developing beyond the average of the last few weeks, inquiries having to do with the speeding up of industrial production are being received in considerable number. A demand for special machinery, in particular, is reported.

The local representative of one of the largest plants in the West turning out milling machines states that, beginning September first, it will be necessary to put on a night shift to meet the increasing demand for its product. Railroads, as for some time past, are buying only single tools, or occasionally a small lot, chiefly for replacement purposes, all former lists having practically been closed.

Dealers in used tools report a slight improvement in sales. The consensus of opinion as expressed by leading concerns is to the effect that by Sept. 15, possibly earlier, a general revival in the machinery industry will be in effect.

CANADA

Sales of machinery and machine tools in Canada are holding up remarkably well for this time of the year. The metal markets generally have been quite active since the beginning of August, and the outlook for the next two or three months is bright.

Conditions in the iron and steel industry are favorable. The Algoma Steel Corporation's rail mill is busy on an extensive order for rails for the Canadian Pacific Ry. Canadian Vickers, Ltd., Montreal, has, during the current year to date, shown a substantial increase over the same period of 1926. The Canadian Bridge Co. has nearly 3,000 tons of steel in process of fabrication for Australian users. The Ontario Steel Products Co. reports sales for the year ending June 30, to have been higher than in any other year in the history of the company.

Building and construction continue to provide much business for manufacturers of small tools. Courtaulds Ltd., of Cornwall, Ontario, are adding to their mill at a cost of $250,000. Vancouver reports that work will start at once on a $2,000,000 elevator for the Alberta Wheat Pool.

Announcement is made that H. W. Petrie Ltd., Toronto, will dispose of its large stock of rebuilt machines, and confine activities to the sale of new equipment. W. R. Campbell, vice-president of the Ford Motor Co. of Canada, reports that the company expects to be employing men on a general production basis by the beginning of September.

Five Hundred Exhibitors at Power Show

The Sixth National Exposition of Power and Mechanical Engineering will be held at the Grand Central Palace, New York, from Dec. 5 to 10, and at the same time the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers will be held. Other organizations will meet at the same time; some of these will meet jointly with, or in bodies attend the Exposition.

The number of exhibitors this year is expected to show an increase over last year. There are now more than 500 exhibitors who will show approximately 400 units of power generation, distribution and utilization; between 200 and 250 exhibits will include heating and ventilating equipment, and refrigeration for large scale industries, factories, office buildings, apartment, public and assembly buildings, and homes. Between 100 and 150 exhibits will show instruments for control of time, pressure, temperature, volume, or what other element requires precision in its measurement or recording. There will be about 125 exhibits or more of machine shop equipment, including metal and wood working machines, transmission equipment, tools and machine tools, and in this phase of the exposition's activities, there has been a marked increase in number of exhibits. There are many new exhibits of transmission equipment. There will be numerous exhibits of materials handling equipment. Mechanical exhibits of all kinds will lead the way to the complete equipment of every industrial plant.

The advisory committee of the exposition co-operating with the management comprises: I. E. Moultrop, chairman, Homer Addams, F. Paul Anderson, N. A. Carle, Willis H. Carrier, Fred Felderman, C. F. Hirshfeld, O. P. Hood, John A. Hunter, E. B. Katte, R. T. Kent, John H. Lawrence, Fred R. Low, David Moffatt Myers, R. F. Pack, Fred W. Payne, Calvin W. Rice, Charles F. Roth and Charles M. Schwab.

The managers report that the exposition will this year occupy four full floors of the Grand Central Palace and that excepting a few spaces still available all space is engaged.

Drop Forgers Will Dine Visitors to Detroit

The Drop Forge Supply Association, of which Charles Harmon, of the Chambersburg-National Co., is president, and Jules Dierckx, of the Keller Mechanical Engraving Corporation, vice-chairman; and C. E. Wertzel, of the Heppenstall Forge and Knife Co., secretary, will tender a dinner to the visiting drop forgers who will be in attendance at the National Steel and Machine Tool Exposition that will be held in Detroit the week of Sept. 19. H. Deane, of the Chevrolet forge division, and Ed. Graham, of A. Finkl & Sons, form the Detroit committee in charge of this dinner. It will be held on Wednesday evening, Sept. 21, at the Harmony Club. Attendance at the dinner will be strictly by tickets. It is requested that all drop forgers in attendance get in touch with Mr. Harmon and make arrangements to attend.

Hanshue Heads Air Transport Body

The American Air Transport Association was organized at a meeting of company executives in Chicago early this month. The membership includes every licensed air transportation company in the United States. The purpose of the association is to provide mutual aid for members in dealing with the Government and the public.

Harris M. Hanshue, president of the Western Air Express, was elected president; T. Clifford Ball, Pittsburgh, vice-president, and W. G. Herron, San Francisco, secretary and treasurer. The directors are Col. Paul Henderson, Chicago; G. S. Childs, Philadelphia; W. B. Robertson, St. Louis; George Tidmarsh, Washington, D. C.; W. T. Varney, San Francisco; and J. F. O'Ryan, New York. Headquarters of the association will be established in Chicago, and the first annual meeting will be held in November.

Companies represented at the organization meeting were: Pitcairn Aviation, Inc., T. Clifford Ball Co., Robertson Aircraft Co., Western Air Express, Colonial Airways, Boeing Air Transport, Inc., Pacific Air Transport, Varney Lines, National Air Transport Co., Ford Air Service, and Stout Air Service.

Railway General Foremen to Meet in Chicago

Six speakers will address the convention of International Railway General Foremen to be held at the Hotel Sherman, Chicago, on Sept. 6 to 9. They are: O. A. Garber, chief mechanical officer, Missouri Pacific R.R. Co.; T. W. Demarest, general superintendent of motive power, western region, Pennsylvania R.R.; A. C. Mann, in charge of purchases, Illinois Central System; C. J. Wymer, superintendent of car department, Chicago & Eastern Illinois Ry. Co.; G. F. Hess, superintendent of motive power, Wabash Railway Co.; and J. G. Morgan, director of personnel, Delaware, Lackawanna & Western R.R. Co. The Association of Railway Supply Men will also participate. Equipment is to be exhibited.

Coal Stocks High

A report of the Bureau of Mines, dated July 1, indicates that there are 62,000,000 tons of coal in the hands of consumers. The Bureau actually received written statements from responsible officers showing that there was 45,859,831 tons held by more than five thousand consumers.

Management Week Plans Making Progress

Interest in the plans and program for this year's Management Week, Oct. 24 to 29, is steadily growing. To date, local organizers have been selected in 58 towns, and local committees have already been formed in ten of these, according to Ray M. Hudson, secretary of the national committee in charge of arrangements. Management Week is sponsored by technical and professional organizations concerned with securing understanding and intelligent direction of the principles of administration and management which govern organized effort for accomplishing industrial efficiency.

The sponsor organizations represented in the committee are the American Society of Mechanical Engineers, Society of Industrial Engineers, Taylor Society, American Management Association, American Institute of Accountants, National Association of Purchasing Agents, National Association of Foremen, National Association of Office Managers, and the Life Office Management Association.

The topic for the 1927 meetings is "Management's Part in Maintaining Prosperity." The national committee regards this topic as very timely because of the high level of prosperity prevailing throughout the United States, and the necessity to consolidate the gains made in recent years as a safeguard against recession.

Among the other organizations that have pledged support and co-operation to the work this year are: The Chamber of Commerce of the United States, the International City Managers' Association, and The National Wholesale Grocers' Association, Associated Industries of Massachusetts, California Manufacturers' Association, Manufacturers Association of Connecticut, Associated Industries of Missouri, New Hampshire Manufacturers' Association, and Retail Credit Men's National Association and several others equally prominent.

S. A. E. Seeks Production Papers and Speakers

A recent classification of the membership of the Society of Automotive Engineers indicates that practically 21 per cent of the members are primarily interested in production.

At the last meeting of the production advisory committee the lack of production papers presented at the section meetings was discussed and it was thought that possibly one reason for this lack is the impossibility or difficulty in getting satisfactory speakers on production topics. The committee, therefore, appointed John Younger as a subcommittee of one to contact with the sections regarding production topics. Mr. Younger will be glad to help any sections officers interested in obtaining such speakers. His address is Ohio State University, Columbus, Ohio.

Personals

W. R. KNEELAND has been appointed manager of roll sales for the Youngstown Foundry and Machine Co.

FRED W. KOHL has been appointed vice-president in charge of sales for the Automotive Tool Manufacturing Co., of Milwaukee.

J. R. SPROAT has been appointed superintendent of the William B. Scaife & Sons Co., of Pittsburgh, succeeding the late G. A. Meckel.

WILLIAM H. MAXWELL, JR., formerly representing a group of industrial publications, on financial advertising, has discontinued this work and has become associated with Hallgarten & Co., of New York.

A. T. KASLEY, formerly head of the research department at the South Philadelphia Works of the Westinghouse Electric and Manufacturing Co., has been appointed consulting engineer at that plant.

S. H. MARCH, representing Alfred Herbert, Ltd., of Conventry, England, large British manufacturer of machine tools, will arrive in the United States about the middle of September.

H. A. ADAMS, JR., who has been manager of the Walworth International Co., in India, for the past seven years, has returned to the United States and has opened offices at 44 Whitehall Street, in New York.

J. A. FRANKLIN, formerly of the industrial sales division of the Cincinnati office of the Westinghouse Electric and Manufacturing Co., has been appointed Cincinnati district manager of the Kaestner & Hecht Elevator Co.

W. W. NICHOLS, vice-president and mechanical engineer of D. P. Brown & Co., has been elected a member of the Institute of Scientific Management of Warsaw, Poland, in appreciation of the valuable work done by him in the field of scientific management.

MARCUS A. CURRAN has resigned his position as assistant to the vice-president of the Graybar Electric Co., of New York, to become vice-president and general manager of the Bryant Electric Co., of Bridgeport, Conn. Mr. Curran will assume his duties at Bridgeport on September first.

WILLIAM E. BROWN, manager of the central station department of the New York district of the General Electric Co., has been appointed New York district sales manager of the company. Mr. Brown's headquarters will be at 120 Broadway, New York.

R. H. NEWTON has been appointed factory representative of the Chain Products Co., in New England and parts of New York, West Virginia and Pennsylvania. Mr. Newton was formerly Southern district manager for the Gates Rubber Co. and the Dayton Rubber Co.

J. S. H. WURTELE, vice-president of the Southern Canada Power Co. and chief engineer in charge of plants of the Power Corporation of Canada, and L. C. Jacobs, engineer in charge of construction of the Power Corporation of Canada, sailed recently for France where they will study the electrical situation on behalf of the Foreign Power Securities Corporation.

ALFRED H. BARTSCH, general sales manager of the American Bosch Magneto Corporation, of Springfield, Mass., has resigned and accepted a position as sales and advertising manager with the General Motors Corporation. Mr. Bartsch will join his new company September first in the New York offices, and later will be stationed in Australia to cover that and the New Zealand and Tasmanian territory.

ARTHUR S. PIERCE, formerly associated with the Boston office of Manning, Maxwell & Moore, Inc., of New York, has been appointed direct factory sales engineer in the Boston territory for the Barnes Drill Co., of Rockford, Ill. This latter company is co-operating in a sales program with the Sundstrand Machine Tool Co., and Mr. Pierce will represent both companies.

KENNEDY H. CRUMRINE, formerly superintendent of the National Acme Co., at Cleveland, and W. H. Halliwell, formerly assistant superintendent of the General Iron Works, have been appointed works manager and superintendent, respectively, of the Gisholt Machine Co., of Madison, Wis. Charles H. Johnson, vice-president and former European sales manager, but recently in charge of production, will have more general control of the company's affairs as executive.

C. E. SKINNER, assistant director of engineering, and W. Bradshaw, of the supply sales department, Westinghouse Electric and Manufacturing Co., sailed on Aug. 17, as delegates to the International Electrotechnical Commission Convention, which will be held at Bellaglo, on Lake Como, Italy, Sept. 4 to 24. Dr. Skinner is chairman of the delegation of standard voltages, chairman of the delegation on traction motors, and is the U. S. representative of the committee of seven nations of the proposed International Standards Association.

Business Items

Robbins & Robbins, of New Orleans, have been appointed representatives in that territory for the Allen-Bradley Co., of Milwaukee.

The Service Combustion Co., of New York, has purchased the plant of the Towar Textile Co., Dorr St., Toledo, Ohio.

James Puller & Co., of Hartford, Conn., manufacturers of automobile truck bodies, disk wheels and other accessories, has taken a lease on land on the Connecticut Boulevard, to be used for future expansion.

Operation of the new forge plant of the Ames Shovel and Tool Company, Anderson, has begun. About 80 per cent of the plant's equipment has been installed and officials expect to have the plant in full operation within a couple of weeks.

The Manhattan Electric Supply Co., of New York, has purchased the plant of the Troy Laundry and Machine Co., at East Moline, Ia. Plans for expansion of the plant are under way.

The Udylite Process Co., of Detroit, has been purchased by the Union Carbide and Carbon Co., and F. J. Fisher. The offices are now located at 3220 Bellevue Ave., Detroit.

The Rotor Air Tool Co. has purchased the pneumatic tool division of the Warner & Swasey Co., of Cleveland. Several types of air operated tools are in process of development and will be placed on the market soon.

The Falk Corporation, of Milwaukee, manufacturer of herringbone gears, speed reducers, flexible couplings, oil engines and steel castings, announces the opening of an office in Portland, Oregon, at 720 Terminal Sales Bldg. This office will be in charge of John Jurgensen, who has been in the company's New York office for seven years.

Obituaries

A. B. ARMSTRONG, general manager of the Superior Machine Tool Co., died on July 29.

ARTHUR F. MERRY, mechanical superintendent at the Erie Works of the General Electric Co., died on Aug. 7. Mr. Merry had been with the company for more than twenty years, and was well-known in the mechanical field.

JOHN M. DUNDON, assistant works manager of the Pierce-Arrow Motor Car Co., died at his summer home near Buffalo on Aug. 14. He was 48 years old. Mr. Dundon had been employed by the Pierce-Arrow company for 20 years. Starting as foreman of the toolroom, he became chief of the aircraft work in which the factory was engaged.

JAMES H. FAHNESTOCK, retired mechanical engineer, died at Buffalo on Aug. 9, 1927, in his 81st year. He was at one time superintendent of motive power of the Norfolk & Western Railroad. He was also employed by the Niles Tool Works Co., Hamilton, Ohio, from where he moved to Buffalo to become production engineer of the Buffalo Forge Co.

Forthcoming Meetings

Steel and Power Show. First Steel and Power Show in the Varsity Arena, Toronto, Canada, sponsored by the Montreal and Toronto Chapters of the American Society for Steel Treating; by the Canada, Toronto and Hamilton Councils of the Universal Craftsmen's Council of Engineers; by the Engineers' Mutual Benefit Fund; the American Electroplaters' Society; and the Canadian section of the American Welding Society. Aug. 31 to Sept. 2. General chairman, C. Bradshaw, 153 University Ave., Toronto, Canada.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Society of Automotive Engineers. Production Meeting, starting at Hotel Winton, Cleveland, Sept. 19 and 20; continuing at Hotel Statler, Detroit, Sept. 21 and 22. C. E. Heywood, manager of meetings, 29 West 39th St., New York City.

American Welding Society. Fall meeting, Book-Cadillac Hotel, Detroit, Sept. 19 to 23. M. M. Kelly, secretary, 29 West 39th St., New York City.

Institute of Metals. Sectional meeting, Hotel Statler, Detroit, Sept. 19 to 23, H. Foster Bain, general secretary, 29 West 39th St., New York City.

National Steel and Machine Tool Exposition. Under the auspices of the American Society for Steel Treating. Convention Hall, Detroit, Sept. 19 to 23. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Machine Tool Builders' Exposition. First annual machine tool exposition, conducted by the National Machine Tool Builders' Association, at the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, chairman of the exposition committee. Roberts Everett, manager of the exposition, Pennsylvania Bldg., New York. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Building, Cincinnati, Ohio.

American Gear Manufacturers Association. Fall meeting, Mount Royal Hotel, Montreal, Canada, Oct. 20, 21 and 22. T. W. Owen, secretary, 2443 Prospect St., Cleveland, Ohio.

American Institute of Steel Construction. Annual convention at Pinehurst, North Carolina, Oct. 25 to 29. Charles F. Abbott, executive director, 285 Madison Ave., New York City.

National Association of Manufacturers. Annual convention, Read House, Chattanooga, Tenn., Oct. 25, 26 and 27. George S. Doudinot, secretary, 50 Church St., New York City.

American Society of Mechanical Engineers. National management meeting, Rochester, N. Y., Oct. 26-27. Charles W. Lytle, chairman, Management Div., 29 W. 39th St., New York City.

National Founders Association. Convention, Hotel Astor, New York, N. Y., Nov. 16-17. J. M. Taylor, secretary, 22 S. La Salle St., Chicago.

National Exposition of Power and Mechanical Engineering. Sixth annual event in the Grand Central Palace, New York, Dec. 5 to 10. Charles F. Roth, manager, Grand Central Palace, New York City.

The Weekly Price Guide

Rise and Fall of the Market

THE price of $1.80 per 100 lb. on steel bars, shapes and plates, base, Pittsburgh, holds firmly, with principal makers regarding it as low, regardless of size of order. Structurals appear in good demand, with pipe, bars and sheets, the most active items on the steel list. Railway and automotive material, wire products and tin plate move slowly at present. Pig-iron prices are regarded by some as being near to cost of production. Linseed oil rose 2¼c. per 7½-lb. gal. this week at New York; fabricated brass and copper moved higher at New York and Chicago warehouses. Iron and steel scrap shows mild activity in buying; old non-ferrous metals, however, advanced slightly in the New York market, over the week end.

(All prices as of Aug. 19)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	17.75
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.25	3.50	3.25	3.89
No. 12	2.30	3.55	3.30	3.94
No. 14	2.35	3.60	3.35	3.99
No. 16	2.45	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.80	3.75	3.55	4.00
No. 22	2.95	3.90	3.70	4.15
No. 24	3.00	3.95	3.75	4.20
No. 26	3.10	4.05	3.85	4.30
No. 28	3.25	4.20	4.00	4.45
Galvanized				
No. 10	3.15	4.10	3.95	4.25
Nos. 12 to 14	3.25	4.20	4.05	4.35
No. 16	3.35	4.30	4.15	4.45
No. 18	3.50	4.45	4.30	4.60
No. 20	3.65	4.60	4.45	4.75
No. 22	3.70	4.65	4.50	4.80
No. 24	3.85	4.80	4.65	4.95
No. 26	4.05	5.05	4.90	5.20
No. 28	4.30	5.30	5.15	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	¾	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn, round and hex.†	4.00	3.65	3.60
Cold drawn, flats and squares	4.50	4.15	4.10
Structural shapes (base)	3.34	3.00	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.65	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ¼, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †Shafting and screw stock.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			14.37½
Tin, pigs, 5-ton lots, New York			64.25
Lead, pigs, up to carlots, E. St. Louis	6.45	New York	7.25
Zinc, slabs, up to carlots, E. St. Louis	6.40	New York	7.37½

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	12.00	....	13.00
Copper sheets, base	22.00	22.00	22.00
Copper wire, base	18.75	18.75	15.25*
Copper bars, base	21.50	21.50	21.50
Copper tubing, base	23.75	24.62½	24.00½
Brass sheets, high, base	18.25	18.25	18.25
Brass tubing, high, base	23.12½	23.12½	23.12½
Brass rods, high, base	16.00	16.00	16.00
Brass wire, high, base	18.75	18.75	18.75

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	11.00	11.55	10.11
Solder (½ and ½), (case lots)	40.00	40.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	83.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	13.00

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	39.00
Shot	36.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.62½@11.87½	10.75	10.25@10.75
Copper, heavy, and wire	10.87½@11.37½	10.75	10.00@10.50
Copper, light, and bottoms	11.00 @11.25	9.25	9.00@ 9.50
Heavy lead	5.50 @ 6.00	5.75	5.00@ 5.50
Tea lead	4.50 @ 4.75	3.75	4.00@ 4.50
Brass, heavy, yellow	7.25 @ 7.50	7.00	6.75@ 7.25
Brass, heavy, red	9.00 @ 9.50	9.50	9.00@ 9.50
Brass, light	5.50 @ 6.00	6.00	6.00@ 6.50
No. 1 yellow rod turnings	7.50 @ 8.00	7.00	7.00@ 7.50
Zinc	3.75 @ 4.00	3.25	3.00@ 3.50

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.15½	36 00 per M	.15
Sal soda, per lb	.03¾	.02	02½
Roll sulphur, per lb	.027	03½	04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.86½	.91	.83½
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	65	.50	50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	27	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	30–10–5%
Heavy grade	30–10%	30–10%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.16	.1525	.1712½
Solder (½ and ½)	per lb.	.40	.39	.4062½
Cotton waste, white	per lb.	.10@13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.27	.27	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	3.00@3.25
Coke, prompt foundry, per net ton		Connellsville,	4.25@4.75
White lead, dry or in oil,	100 lb. kegs	New York,	13.75
Red lead, dry,	100 lb. kegs	New York,	13.75
Red lead, in oil,	100 lb. kegs	New York,	15.25

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Broken Kegs or Cases	Full Kegs or Cases
Machine bolts, square heads and nuts:		
Up to ¾ x 6-in	50%	50–10%
Larger up to 1 x 30-in	45%	50%
1¼ and 1½ in. dia	30%	35%
Carriage bolts:		
Up to ½ x 6-in	50–10%	.....
Larger sizes	50%	.....
Coach and lag screws:		
Up to ½ x 6-in	50–10%	.....
Larger sizes	50%	.....
Tap bolts, hexagonal heads	45%	.....
Nuts:		
Hot pressed, square and hexagonal, blank or tapped	45%	50–10%
Cold punched, square and hexagonal, blank or tapped	45%	50–10%
Semi-finished, hexagonal, tapped, in packages	40%	.....
Case hardened, hexagonal, tapped, in packages	30%	.....
Washers: Deduct from list, per 100 lb.	$1.50	$3.50
Rivets, button and cone head:		
Small, including 7/16-in. dia	.....	50–10%
Large (base) per 100 lb.	$6.50	$5.00

EXTRA per 100 lb. on rivets: For ½-in. dia., 35c.; ⅝-in., 15c.; 1-in., 5c.; length 1-in. and shorter, 25c.; longer than 1-in. up to and including 1 ½-in., 15c.; longer than 5-in., 25c.; standard countersunk head, 25c.

Machine Requirements and Industrial Construction

Equipment Wanted

Mich., Detroit—Higgins Brass Mfg. Co., 12435 Dequindre St.—complete equipment for the manufacture of brass products for proposed 1 story, 80 x 200 ft. factory.

Mich., Detroit—National Stamping Co., 617 Glover Ave.—one medium duty power press.

O., Marion — Arthur F. King Co., A. F. King, Pres. and Mgr.—one 24 in. lathe, two drill presses, one automatic grinder and reamer and other equipment for plant.

Pa., Franklin—Chicago Pneumatic Tool Co., 572 West Randolph St., Chicago, Ill.—one 15-ton overhead crane, drill presses and milling machines, etc. for proposed 1 story, 100 x 295 and 180 x 220 ft. foundry and machine shop. Estimated cost $250,000.

Tex., Corpus Christi — Corpus Christi Oldsmobile Co., c/o F. W. Barnhart—machinery and equipment including lathes, drill presses, welding machines, etc. for proposed 2 story, 50 x 150 ft. garage. Estimated cost $40,000.

Wis., Milwaukee — Geuder, Paeschke & Frey Co., St. Paul Ave. and 15th St.—prices and catalogs on a flanging machine for flanging the ends of a No. 11 gage steel cylinder, 30⅛ in. diameter x 25⅛ in. long, both ends to be flanged in about 2½ in.

Ont., Hamilton — Hamilton Street Railway Co.—prices and catalogs on general equipment for proposed 1 and 2 story, 80 x 200 ft. repair shops, etc. Estimated cost $400,000.

Ont., Walkerton—Larsen & Shaw Ltd.—prices and catalogs on equipment for the manufacture of spools and bobbins for proposed addition to factory. Estimated cost $10,000.

Que., Montreal—E. Brabant, 40 Duke St.—complete equipment for bracksmith and wheelright shops.

Opportunities for Future Business

Calif., Berkeley—Bd. of Regents, University of California, plans the construction of a group of buildings including electrical and civil engineering departments on University Campus. Estimated cost to exceed $150,000. G. W. Kelham, 315 Montgomery St., San Francisco, Archt.

Calif., Oakland—Harrison Realty Co., 1424 Harrison St., awarded contract for the construction of a 3 story garage on Alice St. Estimated cost $165,000.

Calif., San Francisco—Bauer Cooperage Co., 55 Hampshire St., will soon award contract for the construction of a cooperage plant at Keith and Yosemite Aves. Noted July 28.

Calif., San Francisco—Crane Co., 2nd and Brannan Sts., is having plans prepared for the construction of a 1 story addition to pipe shop. Estimated cost $35,000. L. P. Hobart, Crocker Bldg., Archt.

Conn., Bridgeport—F. L. Mills Co., 2316 Fairfield Ave., is having plans prepared for the construction of a 1 story, 100 x 200 ft. sales and service station on Dewey St. Estimated cost $100,000. Fletcher-Thompson Inc., 542 Fairfield Ave., Archt.

Ill., Chicago—The Russakov Can Co., 936 West Chicago Ave., manufacturers of cans and sheet metal products, plans the construction of a 4 story, 75 x 100 ft. plant at Carpenter St. and Ogden Ave. Estimated cost $80,000.

Ill., Chicago—West Chicago Park Comrs., J. J. McComb, Secy., will receive bids until Aug. 30 for the construction of a warehouse and shops at Garfield Park.

Ill., North Chicago—The Heff Mfg. Co., manufacturers of incubators and incubator appliances, plans the construction of a 1 story, 80 x 120 ft. plant. Estimated cost $40,000. L. J. Latz, Waukegan, Archt.

Ind., Auburn—Auburn Auto Co., awarded contract for the construction of a 2 story, 70 x 280 ft. service building. Estimated cost $150,000. Private plans.

Ind., Evansville—United States Furniture Co., plans the construction of a new factory at First Ave. and Belt R.R. to replace fire loss. Estimated cost including equipment $120,000.

Ind., Indianapolis — Rubush & Hunter, American Central Life Bldg., plans the construction of a 2 story, 77 x 205 ft. repair and service garage. Estimated cost $100,000.

Ind., Ligonier—Ligonier Refrigerator Co., awarded contract for the construction of a 3 story, 50 x 95 ft. factory. Estimated cost $100,000. Noted July 28.

Me., Kittery—A. F. Cook is having revised plans prepared for the construction of a 1 story garage and repair shop, etc. Estimated cost $40,000. Dow, Harlow & Kimball, 184 Boylston St., Boston, Archts. Former bids rejected. Noted June 30.

Mass., Waltham (Boston P. O.)—J. W. Gardner, Brookfield Rd., Waverley, awarded contract for the construction of a 1 story repair and service garage here. Estimated cost $40,000.

Mich., Detroit—First National Co., First National Bank, awarded contract for the construction of a 19 story, 129 x 143 ft. garage on Congress St. Noted June 16.

Mich., Flint—Chevrolet Motor Co., will soon award contract for the construction of a 1 story, 200 x 500 ft. addition to factory. Wright & Nice, 4339 South Saginaw St., Archts.

Mich., Lansing—Olds Motor Works, I. J. Reutter, Works Mgr., is receiving bids for the construction of a 1 story, 131 x 600 ft. motor plant, and 2 story, 80 x 900 ft. warehouse. Private plans.

Miss., Jackson—Robinson Bros. Motor Co., is having plans prepared for the construction of a 2 story, 85 x 112 ft. garage. Estimated cost $50,000. E. J. Hull, Merchants Bank Bldg., Archt. Noted Aug. 18.

Mo., St. Louis—Alois Aufrichtig Copper & Sheet Iron Mfg. Co., 900 South Third St., awarded contract for the construction of a 1 and 2 story, 160 x 240 ft. factory Delor St. Estimated cost $100,000. Noted June 9.

Mo., St. Louis—Vesper Buick Auto Co., Grand Lindell Blvds., awarded contract for the construction of a 2 story, 40 x 150 ft. service station at 3900-3912 West Pine Blvd. Estimated cost $150,000.

N. H., Hanover—F. S. Tenney awarded contract for the construction of a 1 story garage and repair shop, etc. Estimated cost $50,000. Wells & Hudson, Archts.

N. J., Hackensack—The Passaic Bergen Welding Co., Clifton awarded contract for the construction of a 1 story, 30 x 120 ft. plant here.

N. J., Irvington—Asher Mfg. Co., 212 Cort St., manufacturers of laundry machinery, awarded contract for the construction of a 1 story, 60 x 175 ft. addition to factory. Estimated cost $40,000.

N. J., Jersey City—J. Begtrub, 3468 Hudson Blvd., awarded contract for the construction of a 3 story, 50 x 90 ft. garage at Hudson Blvd. and Charles St. Estimated cost $150,000. Noted June 2.

N. J., Jersey City—J. Connolly Inc., 623 Jackson St., Hoboken, awarded contract for the construction of a 2 story, 100 x 100 ft. garage at Mongomery and Monn Aves. here. Estimated cost $150,000.

N. J., Newark—Dept. of Public Affairs, City Hall, is having sketches made for the construction of an airport including machine shops, hangars, etc. Estimated cost $700,000. Architect not selected.

N. Y., Brooklyn—The Decorated Metal Mfg. Co., 196 Degraw St., is having plans prepared for the construction of a plant. Estimated cost $45,000. Slee & Bryson, 160 Montague St., Archt.

N. Y., Mount Vernon — J. H. & C. S. Odell & Co., 407 West 42nd St., New York, manufacturers of pipe organs, awarded contract for the construction of a 2 story plant here. Estimated cost $50,000.

N. Y., New York—Bd. of Transportation, 49 Lafayette St., is completing plans for the construction of a car shop and maintenance plant including machine, woodworking, forge and blacksmith shops, etc. at 10th Ave., 207th to 215th Sts. and Hudson River for new subway lines. Estimated cost approximately $3,000,000.

N. Y., New York—W. M. Farrar, 250 8th Ave., Archt., plans the construction of a 3 story, 76 x 188 ft. repair and service garage at 427-31 West St. Estimated cost $100,000.

N. Y., New York—Ortcar Realty Co., 227 West 51st St., awarded contract for the construction of a 6 story, 100 x 200 ft. garage at 211 West 61st St. Estimated cost $300,000.

O., Cleveland—The Marble & Shattuck Chair Co., T. W. Foote, Mgr., 10200 Foster Ave., awarded contract for the construction of two 4 story, 66 x 121 and 80 x 100 ft. factory buildings. Estimated cost $200,000. Noted July 28.

O., Cleveland — Oregon-Twenty First Building Co., awarded contract for the construction of addition to motor truck freight terminal at 21st and Oregon Sts. Estimated cost $45,000. Knutsen Motor Trucking Co., 2100 Rockwell St., lessee.

O., Columbus — Dept. of Highways & Public Woroks, G. F. Schlesinger, Dir., Ohio-Hartman Bldg., is having plans prepared for the construction of a 1 story, 30 x 80 ft. repair and service garage at State Fair Grounds. Estimated cost $25,000. H. B. Briggs, Ohio-Hartman Bldg., Archt.

O., Hamilton—Central Motor Co., Market and Front Sts., awarded contract for the construction of a 1 story, 47 x 150 ft., addition to repair and service garage. Estimated cost $37,000.

O., Hicksville—Crooks Sons Co., manufacturers of implement handles, awarded contract for the construction of a 1 story factory. Estimated cost $14,000.

Pa., Philadelphia—Auto Club of Philadelphia, 23rd and Ludlow Sts., awarded contract for the construction of a 2 story, 120 x 230 ft. addition to garage. Noted Aug. 11.

Pa., Philadelphia — Otis Elevator Co., Otis Bldg., awarded contract for the construction of a 3 story, 60 x 162 ft. plant at 19th and Buttenwood Sts.

Tex., Big Springs—Texas & Pacific Ry. Co., Dallas, is having preliminary surveys made for rebuilding general shops recently destroyed by fire here. Estimated cost $100,000. E. F. Mitchell, Ch. Engr.

Va., Richmond—Richmond Storage & Service Garage Inc., recently incorporated at $600,000, plans the construction of a 130 x 164 ft. garage at Sixth and Franklin Sts. Estimated cost $350,000.

Wis., Kewaunee—Leyse Aluminum Co., A. Leyse, Mgr., is receiving bids for the construction of a 2 story, 56 x 97 ft. factory. Private plans. Noted July 28.

Que., Point St. Charles—Canadian National Rys., T. T. Irving, Ch. Engr. Central Region, Toronto, Ont., will receive bids until Aug. 25 for the construction of locomotive and machine shops, etc., here. Estimated cost $200,000.